LEVEL III ②

AFWL-TR-78-158, Pt. 3

AFWL-TR-
78-158
Pt. 3

AC 71 522

AD A071523

SIMULATION DEVELOPMENT FOR TARGET ASSESSMENT

Part 3 of 3

J. A. Earickson

Eric H. Wang Civil Engineering Research Facility
University of New Mexico
Albuquerque, NM 87131

March 1979

Final Report

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Air Force Systems Command
Kirtland Air Force Base, NM 87117

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This technical report has been reviewed and is approved for publication.

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Lt Colonel, USAF
Chief, Civil Engineering Research Division

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Albuquerque, NM 87117

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)
Simulator
HEST (High Explosive Simulation Technique)
Target Assessment
Air Shock

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This effort produced design information and experiment data for improving high explosive simulation of nuclear airblasts. Specifically, a peak pressure versus charge density relationship for Iremits in 100 percent foam cavities was obtained for pressure up to 68 MPa. The results of this effort were transmitted to USAE Waterways Experiment Station. WES is conducting tests on generic silos as part of a DNA targeting research and test program.

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APPENDIX B

DOUBLE-EXPONENTIAL PEAK PRESSURE OVERLAY PLOTS AND CALCULATED RESIDUALS VERSUS X-COORDINATED PLOTS

Accession For
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By______
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Availability Codes
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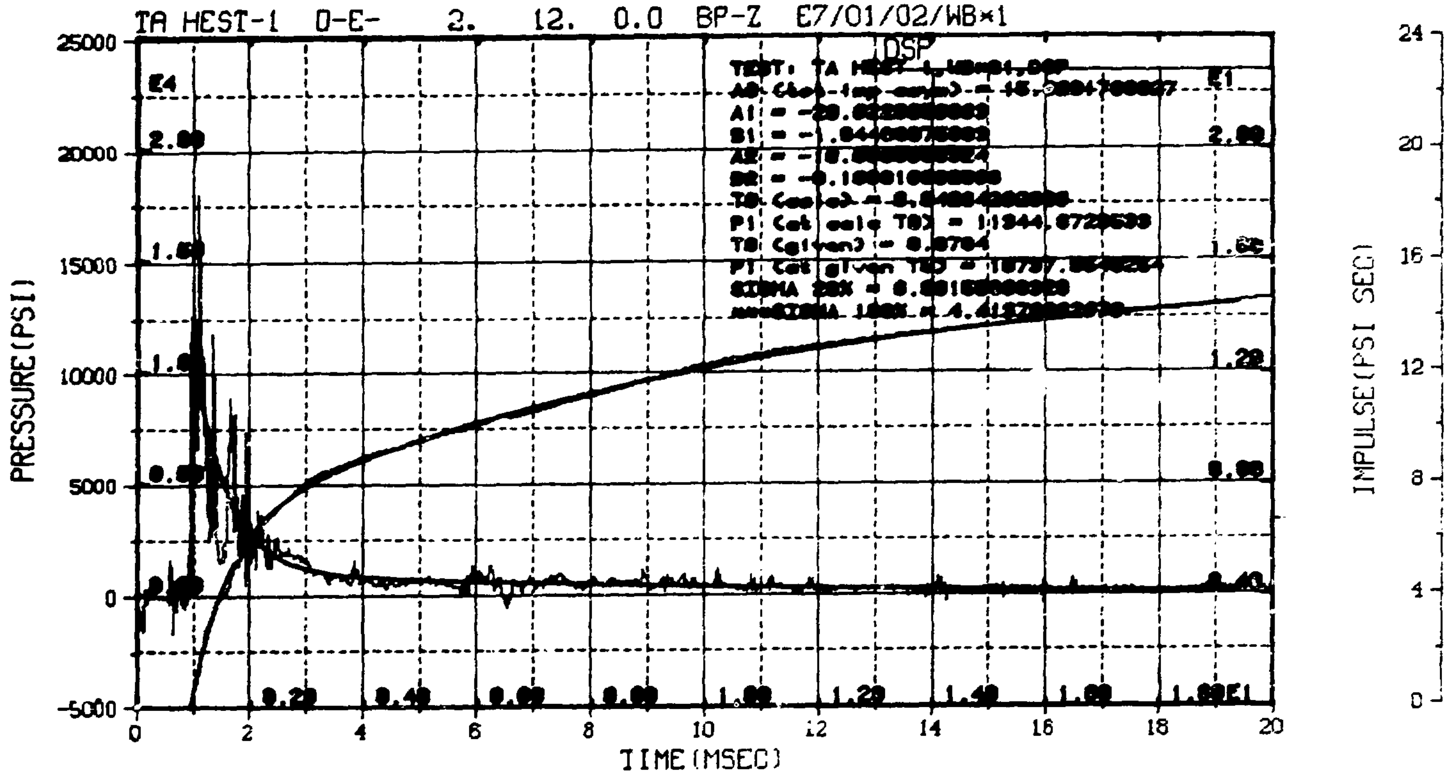

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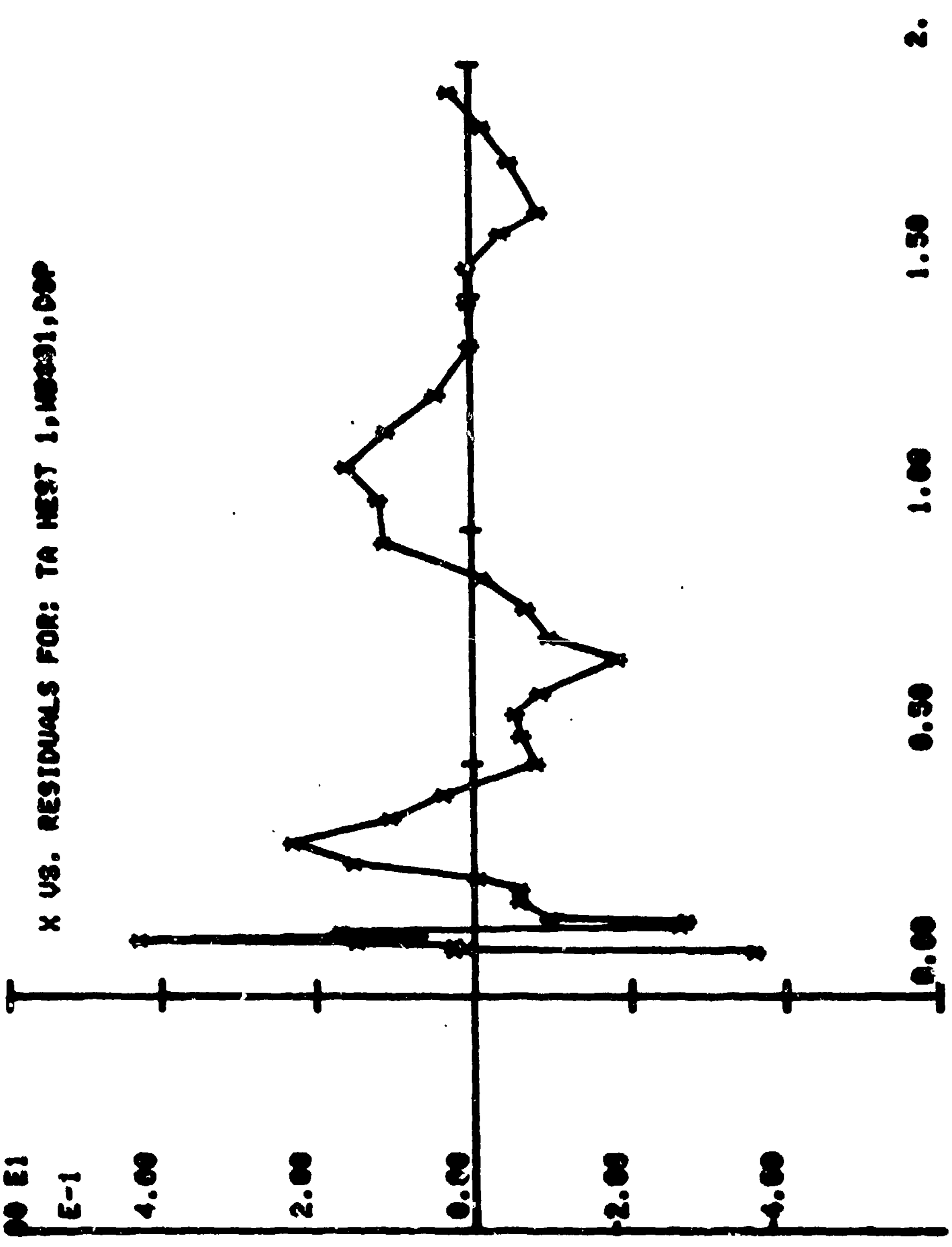
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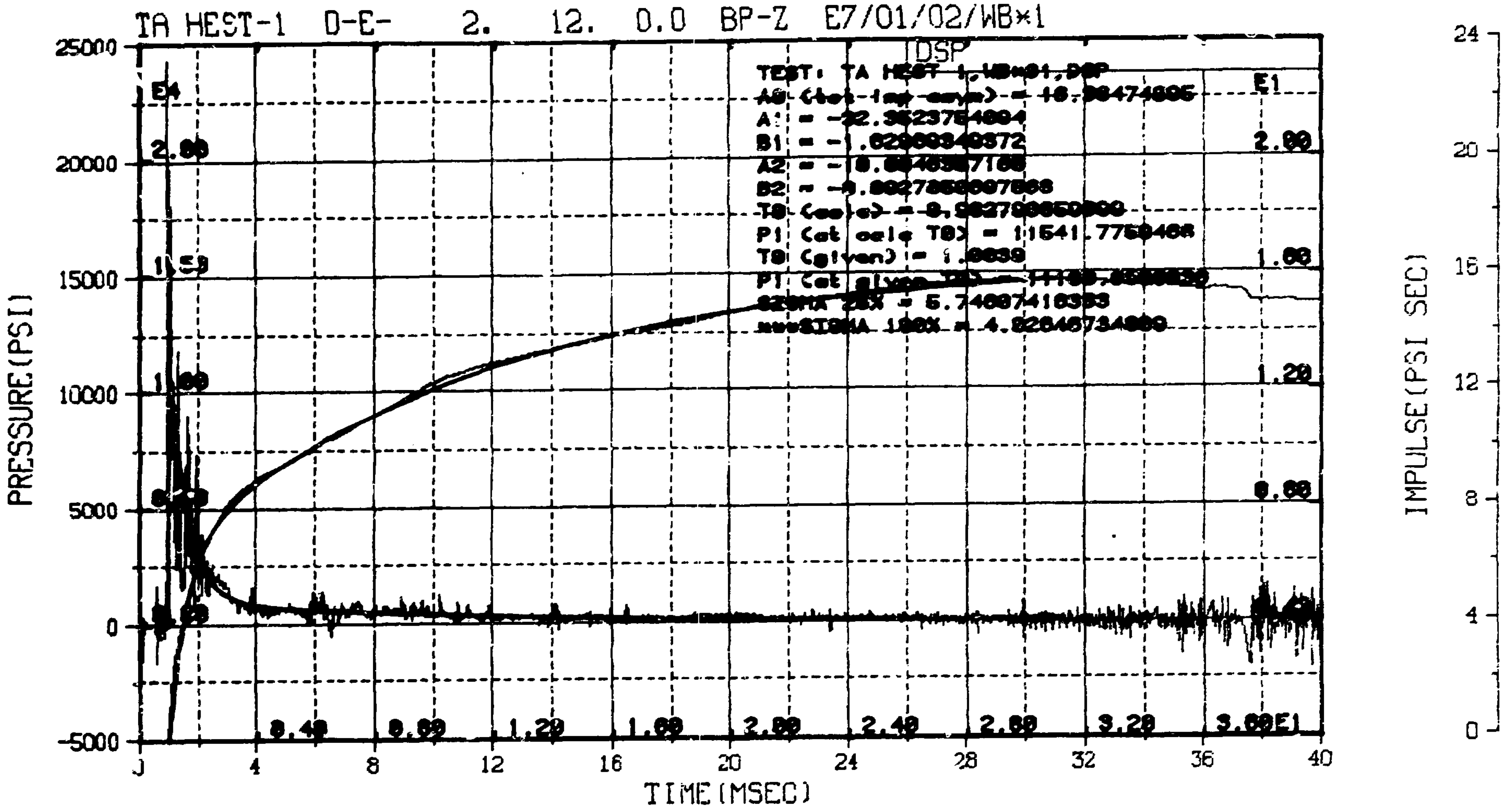

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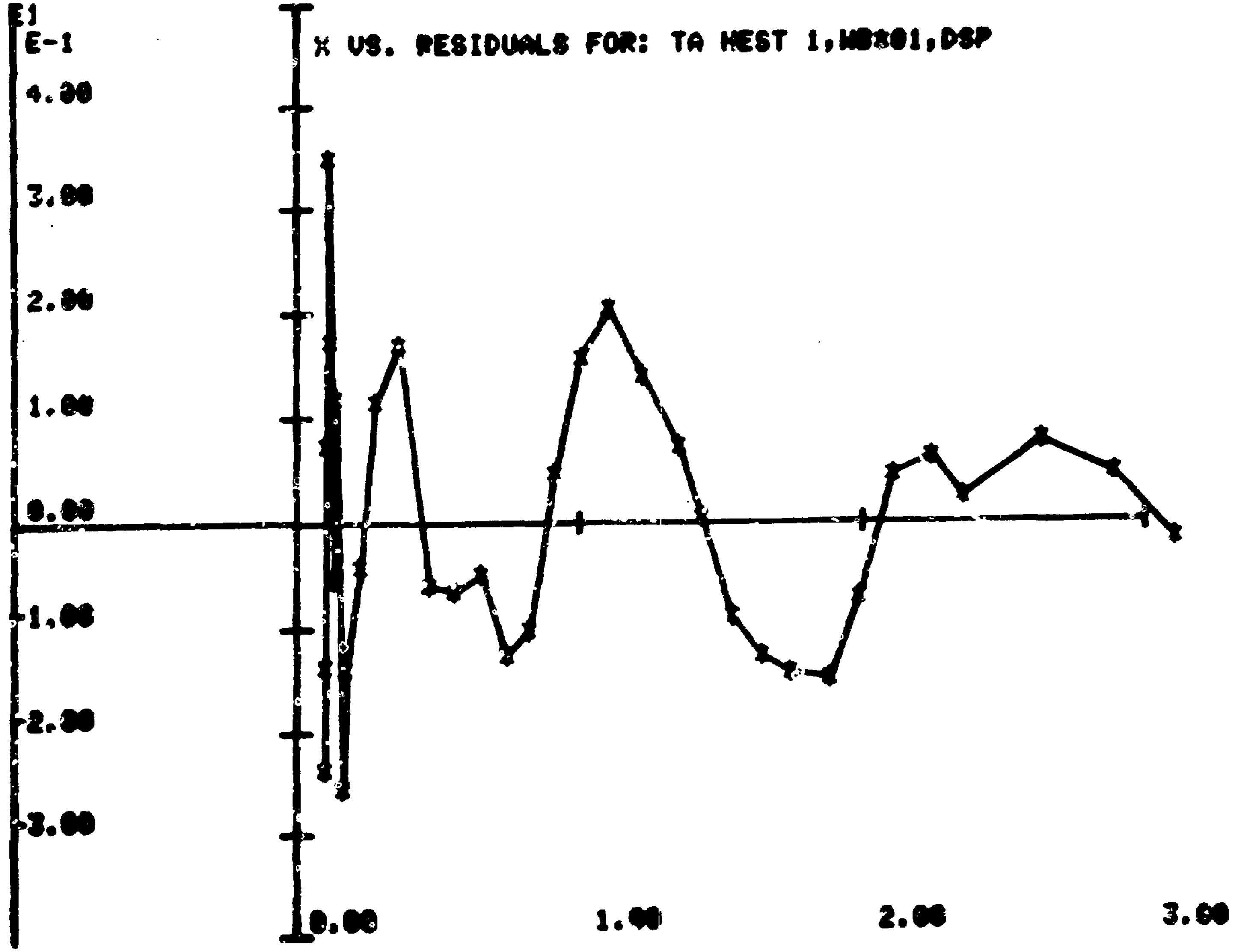
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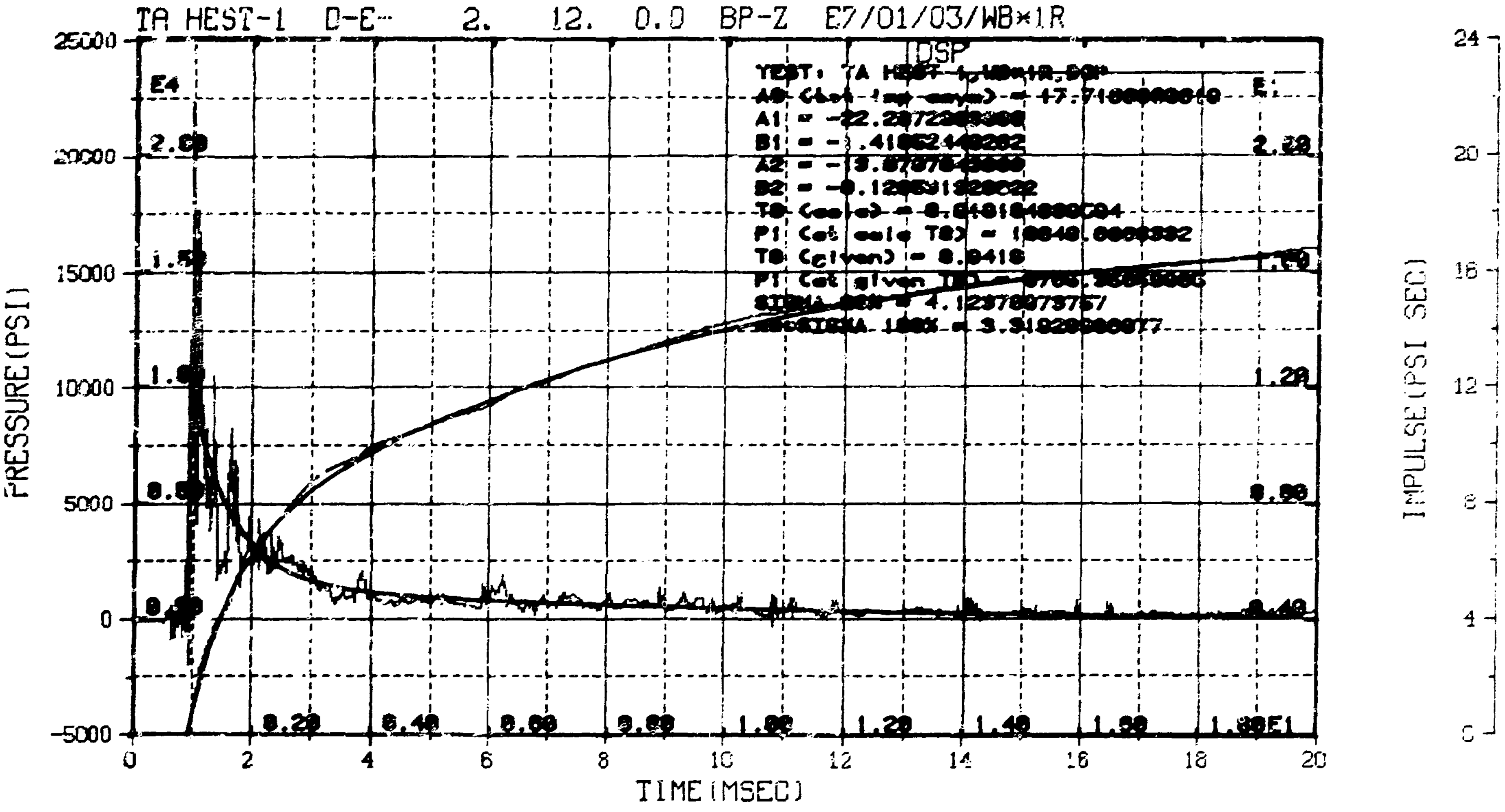

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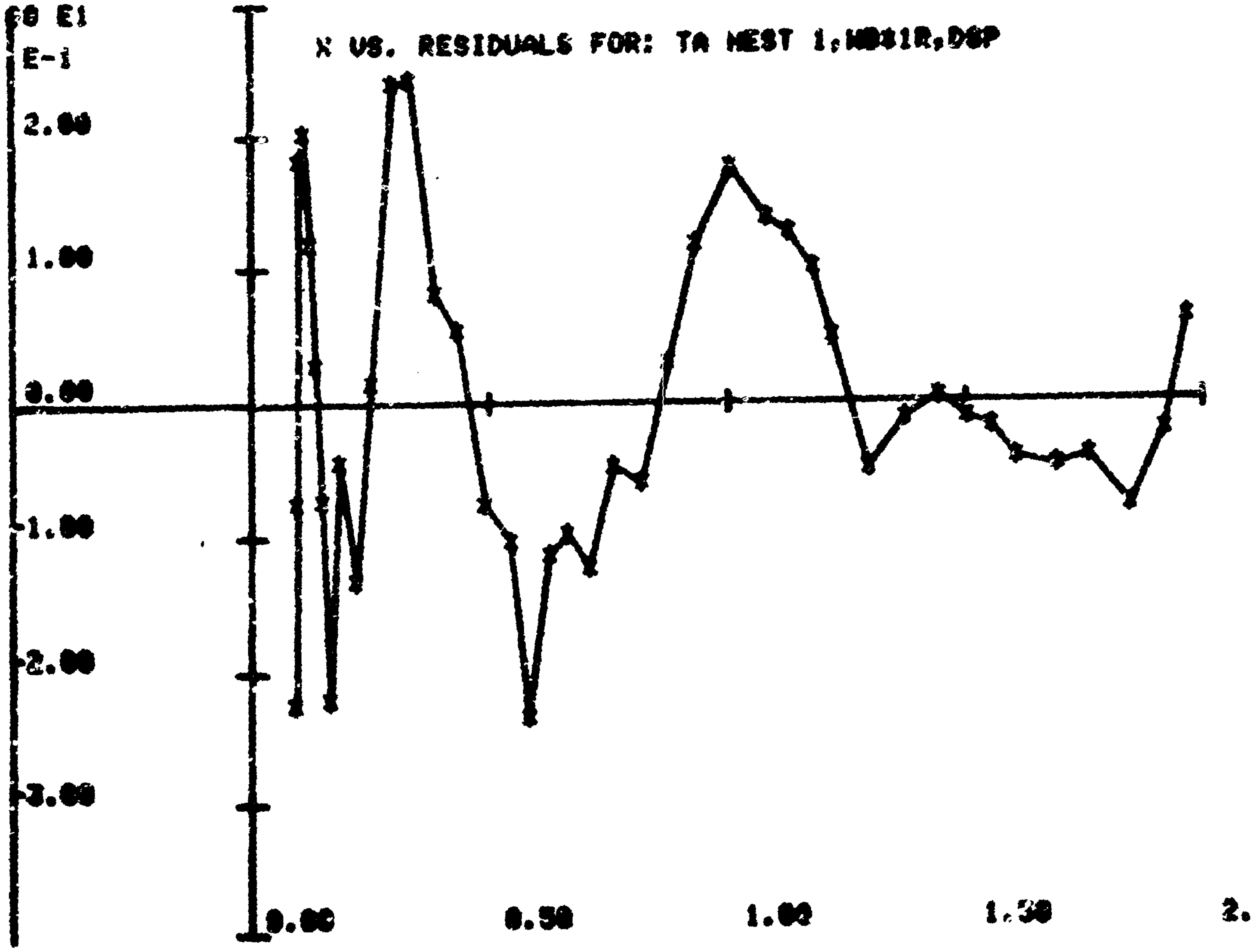
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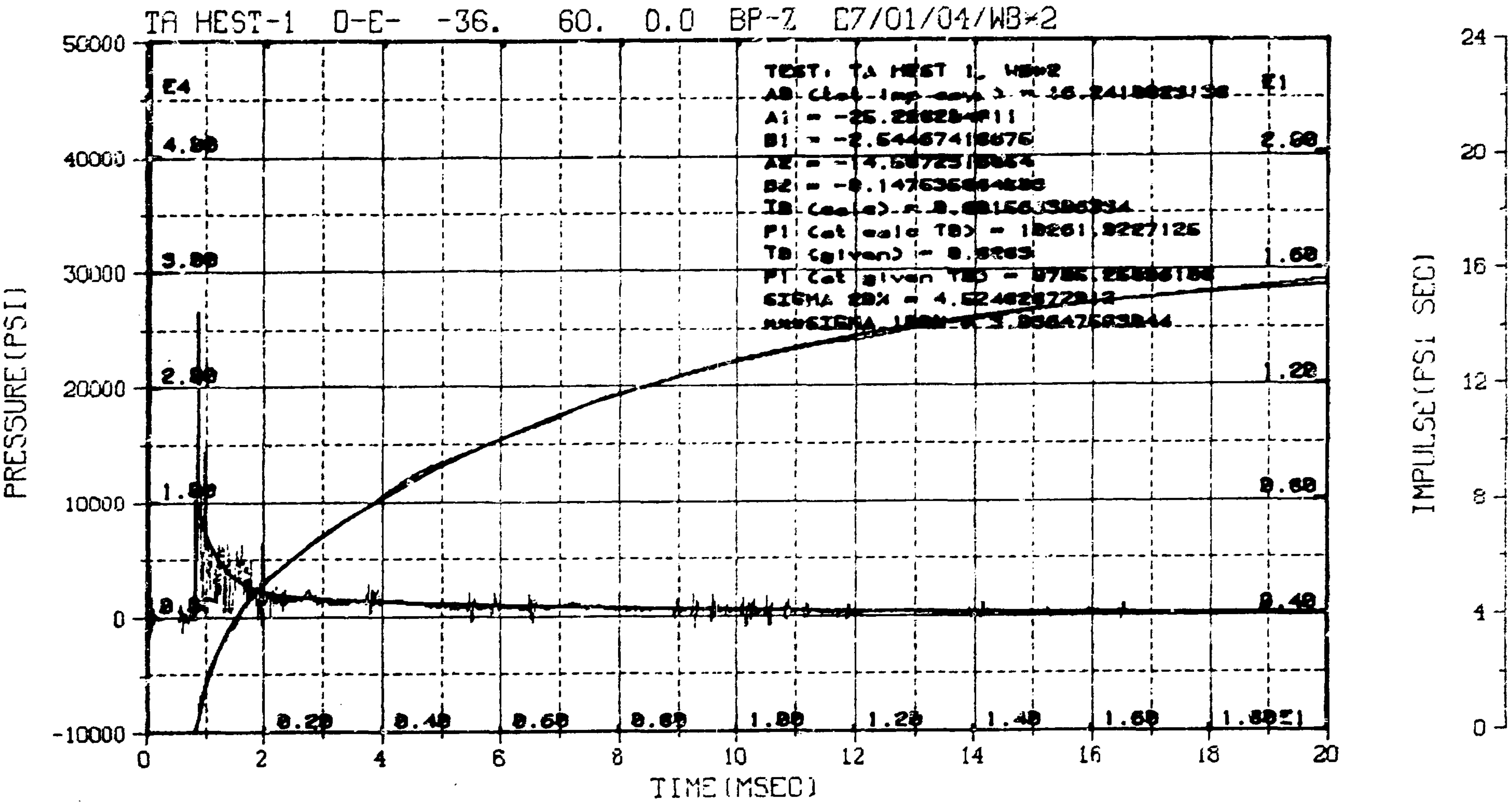

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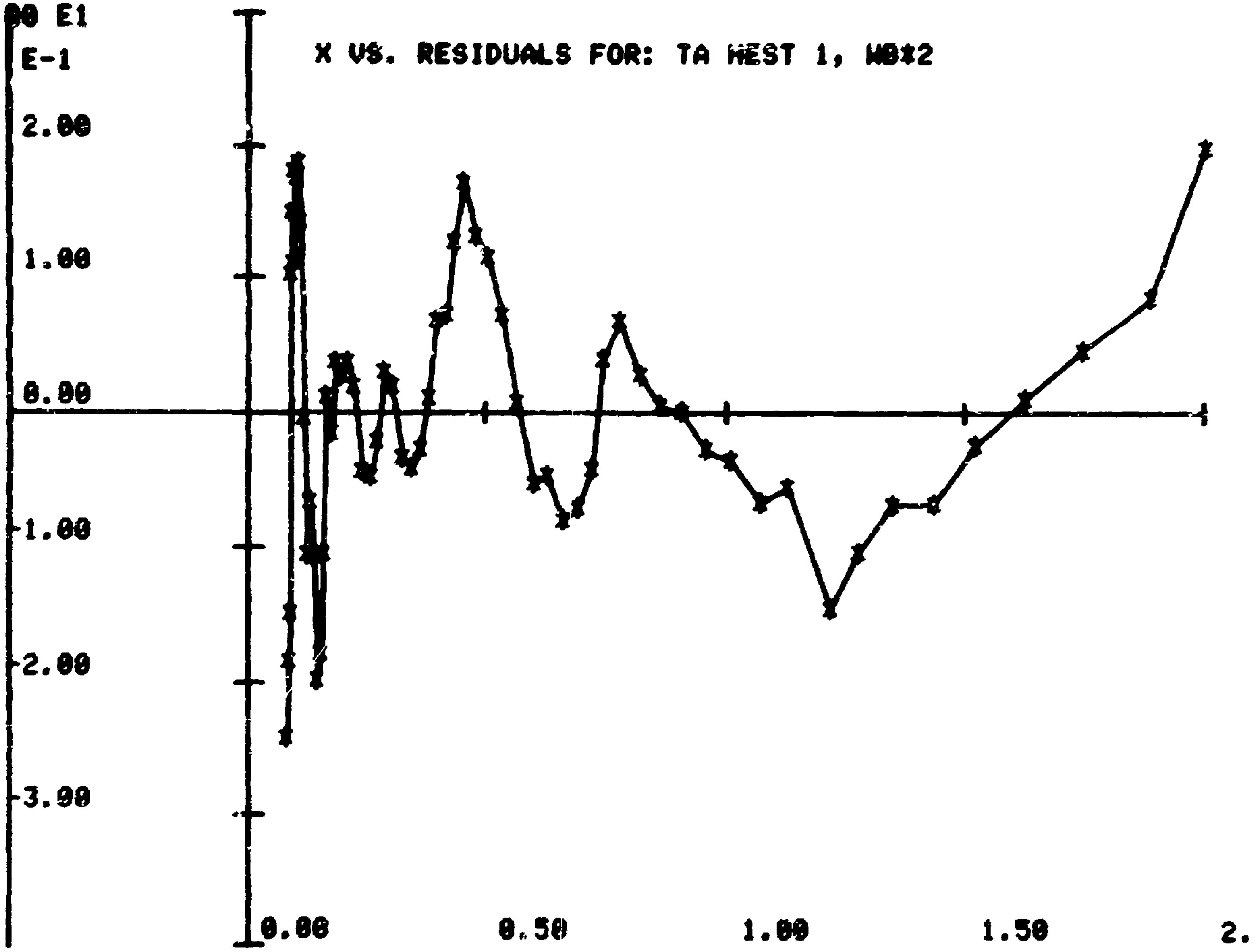
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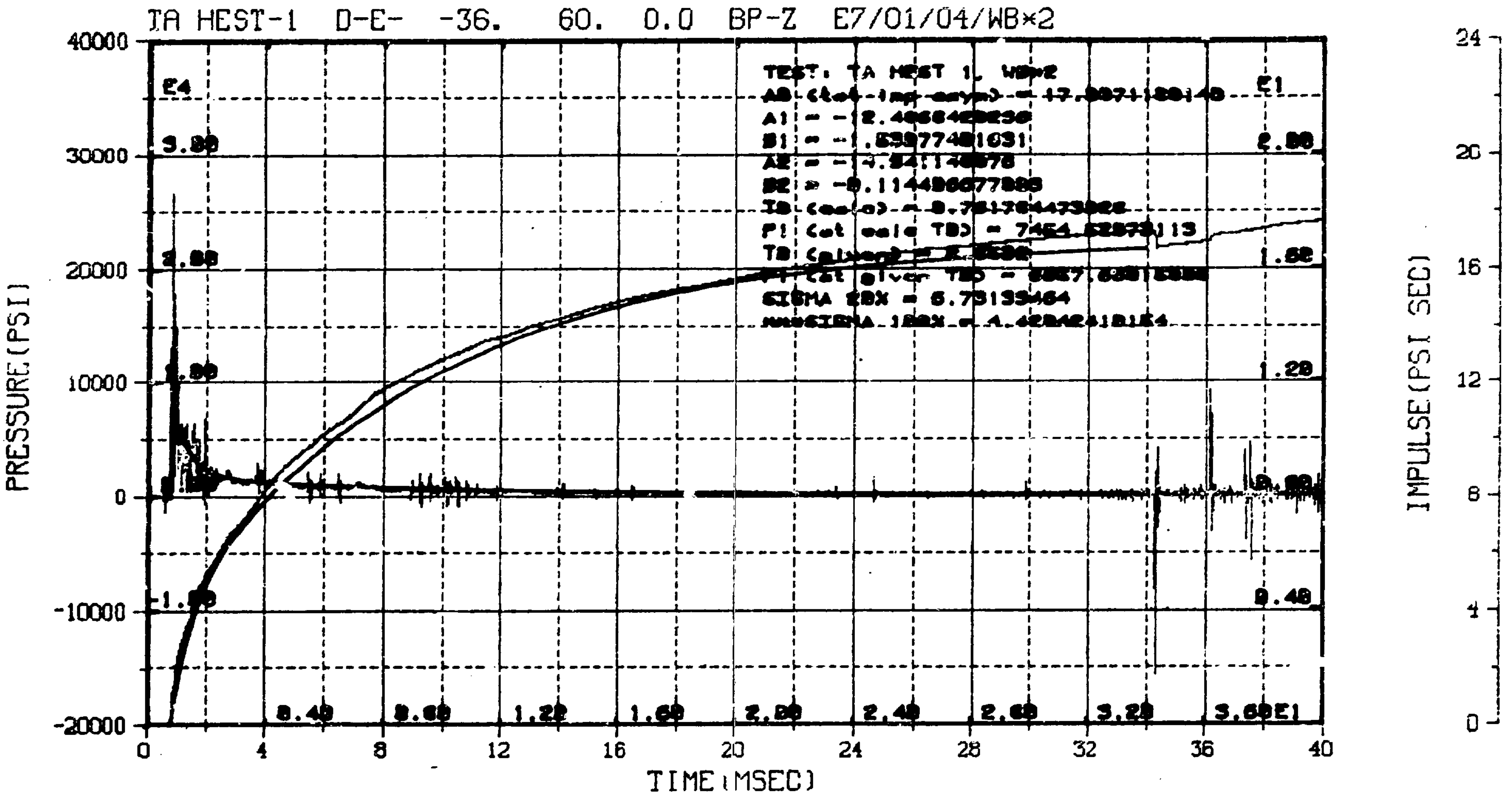

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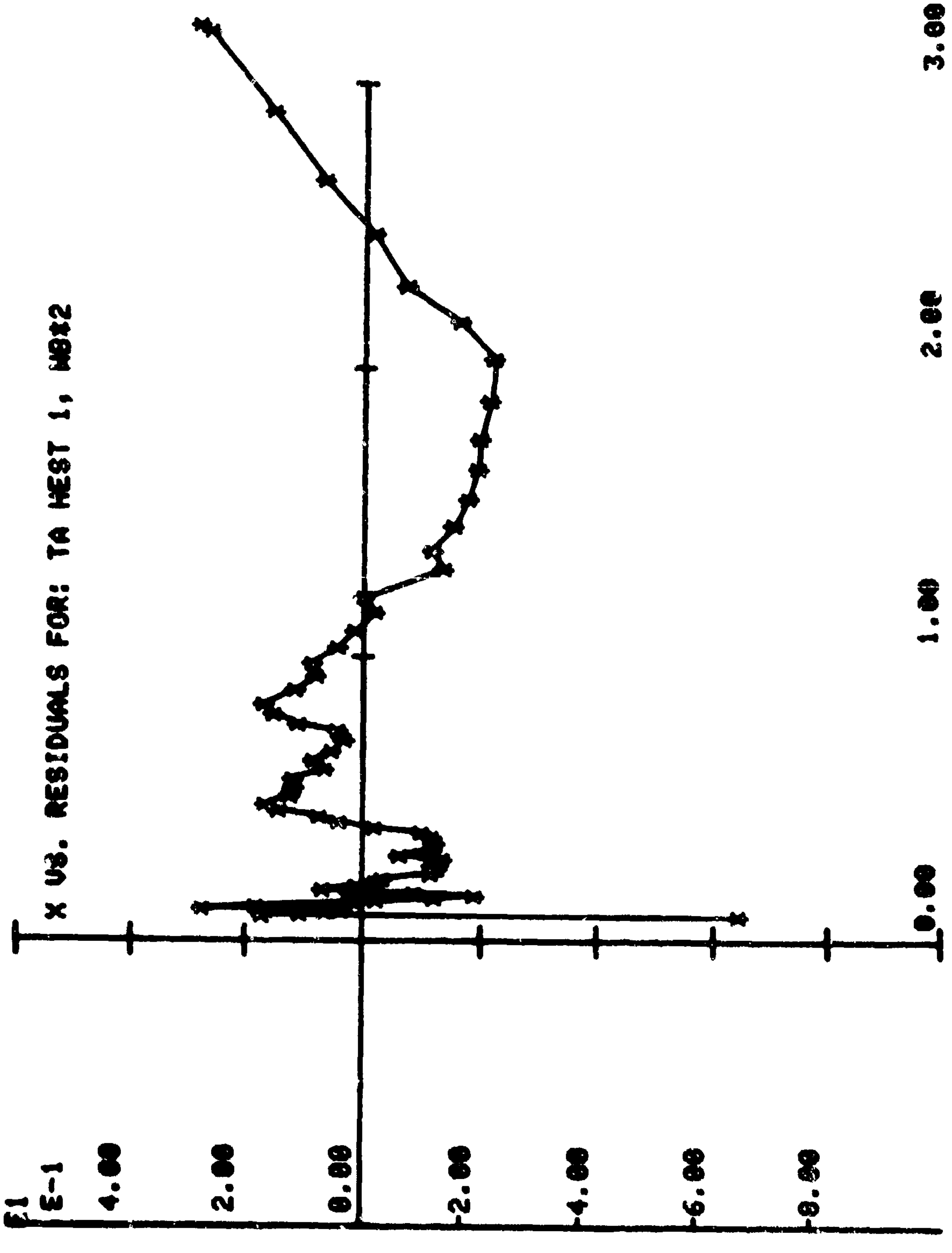
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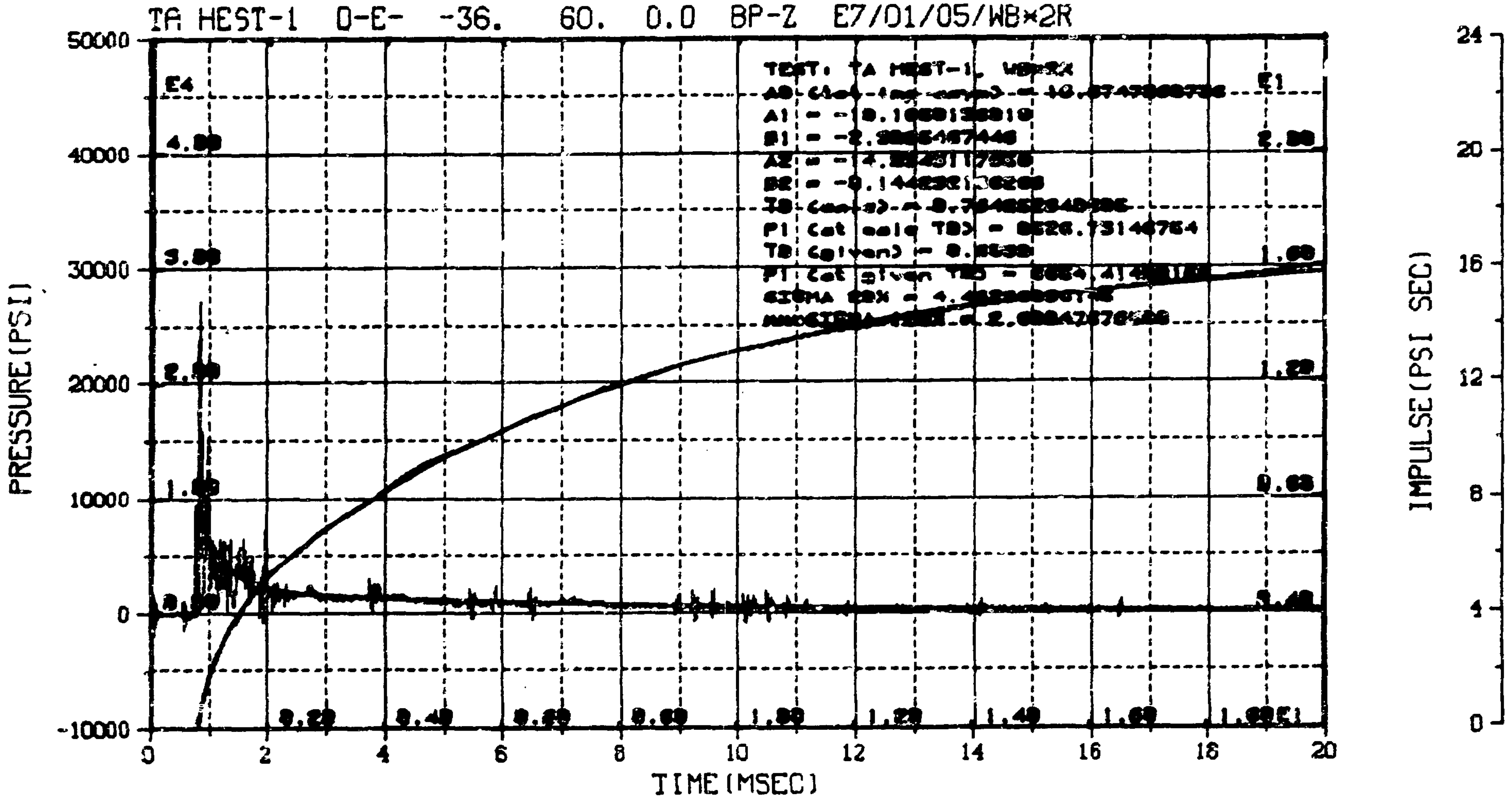

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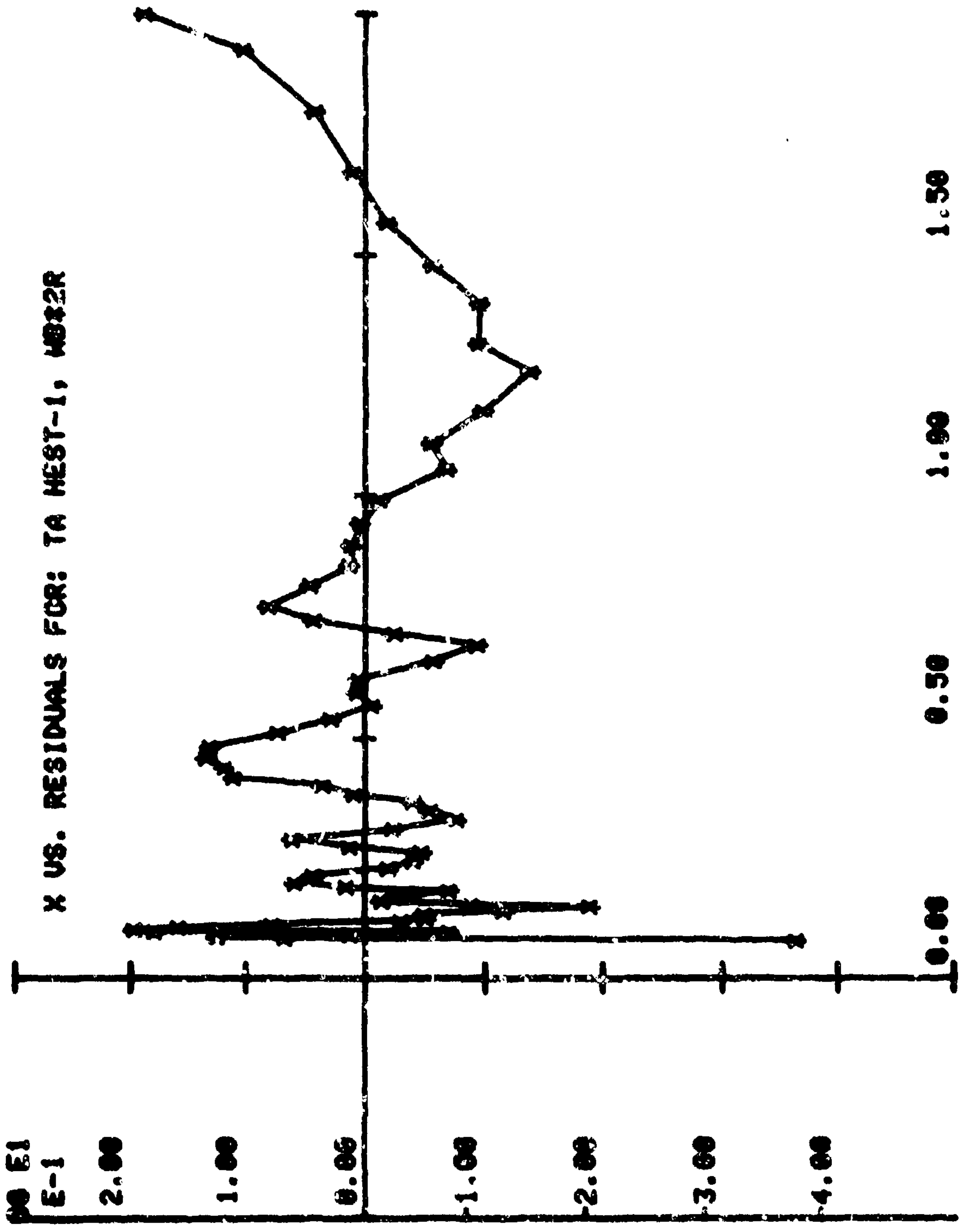
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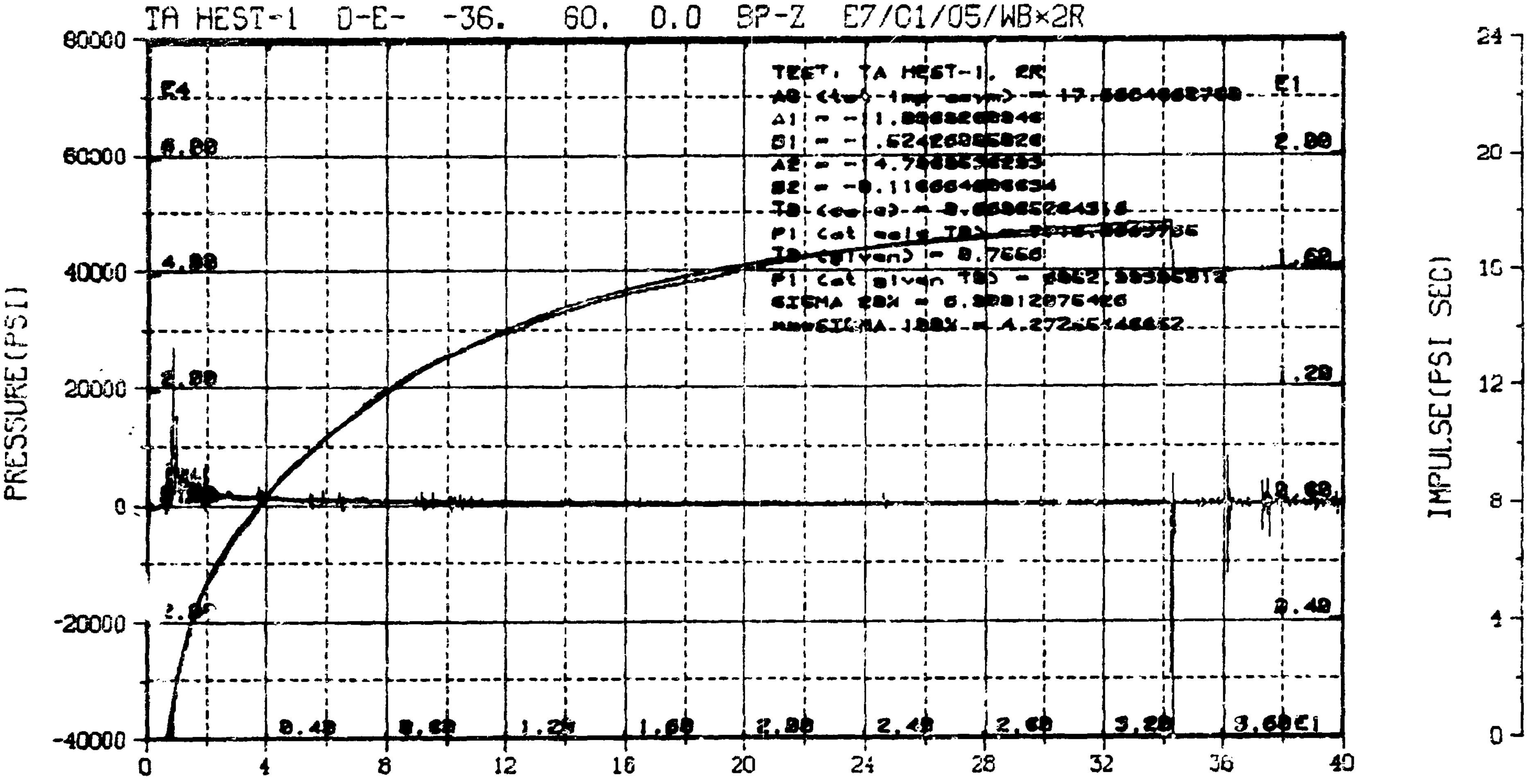

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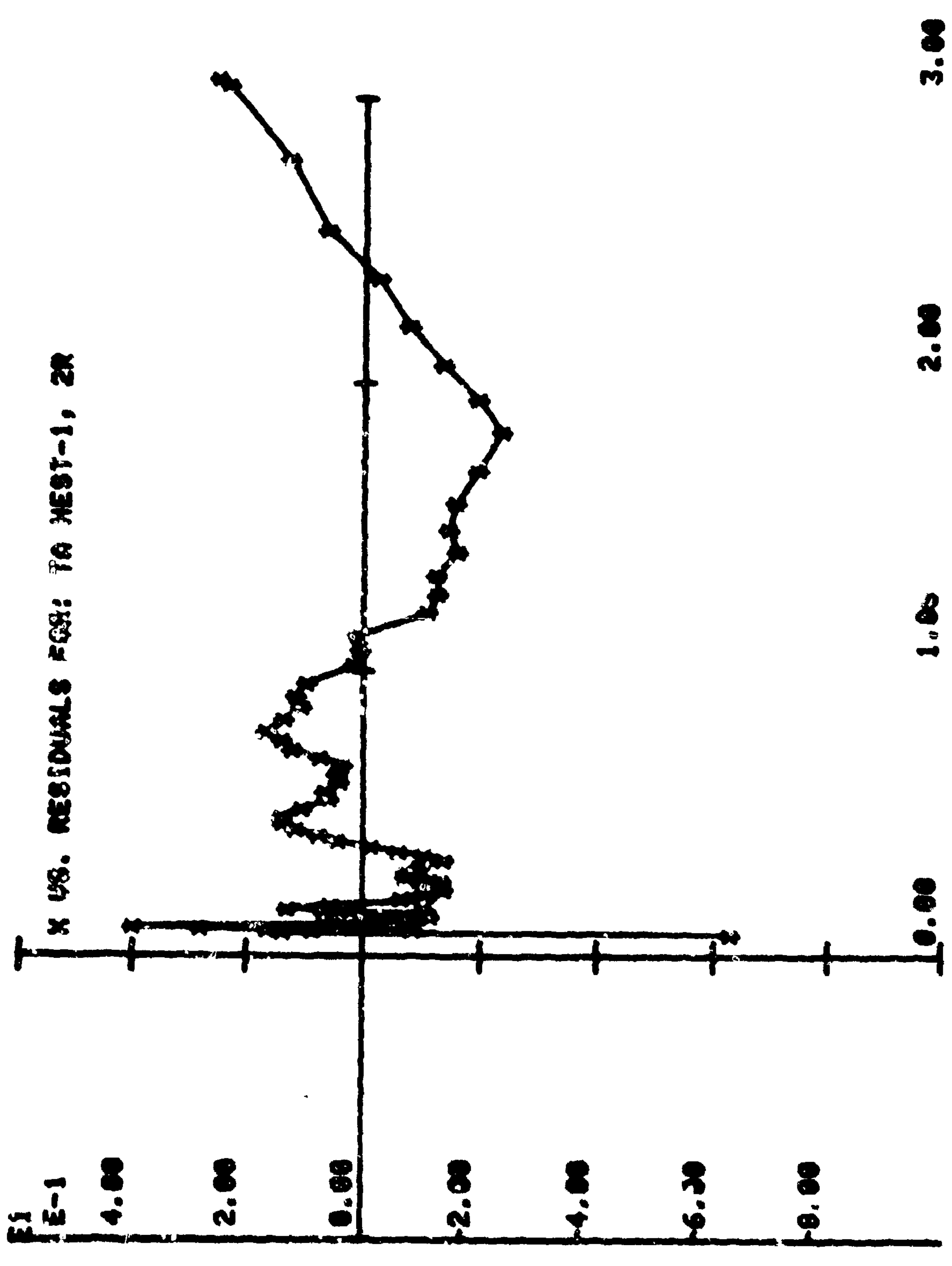
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1.00
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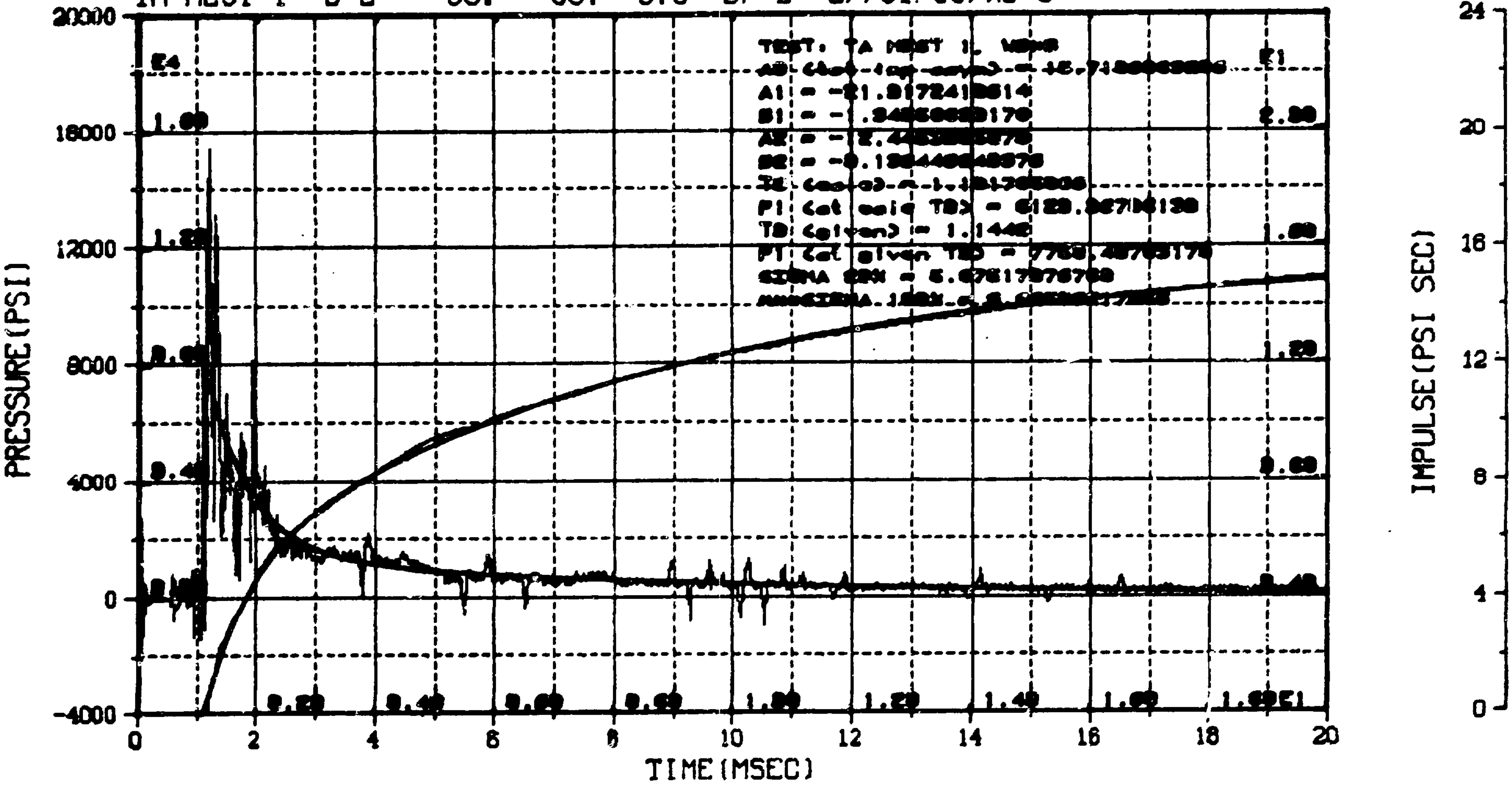
TA HEST-1 D-E- -36. -36. 0.0 BP-Z E7/01/06/WB×3



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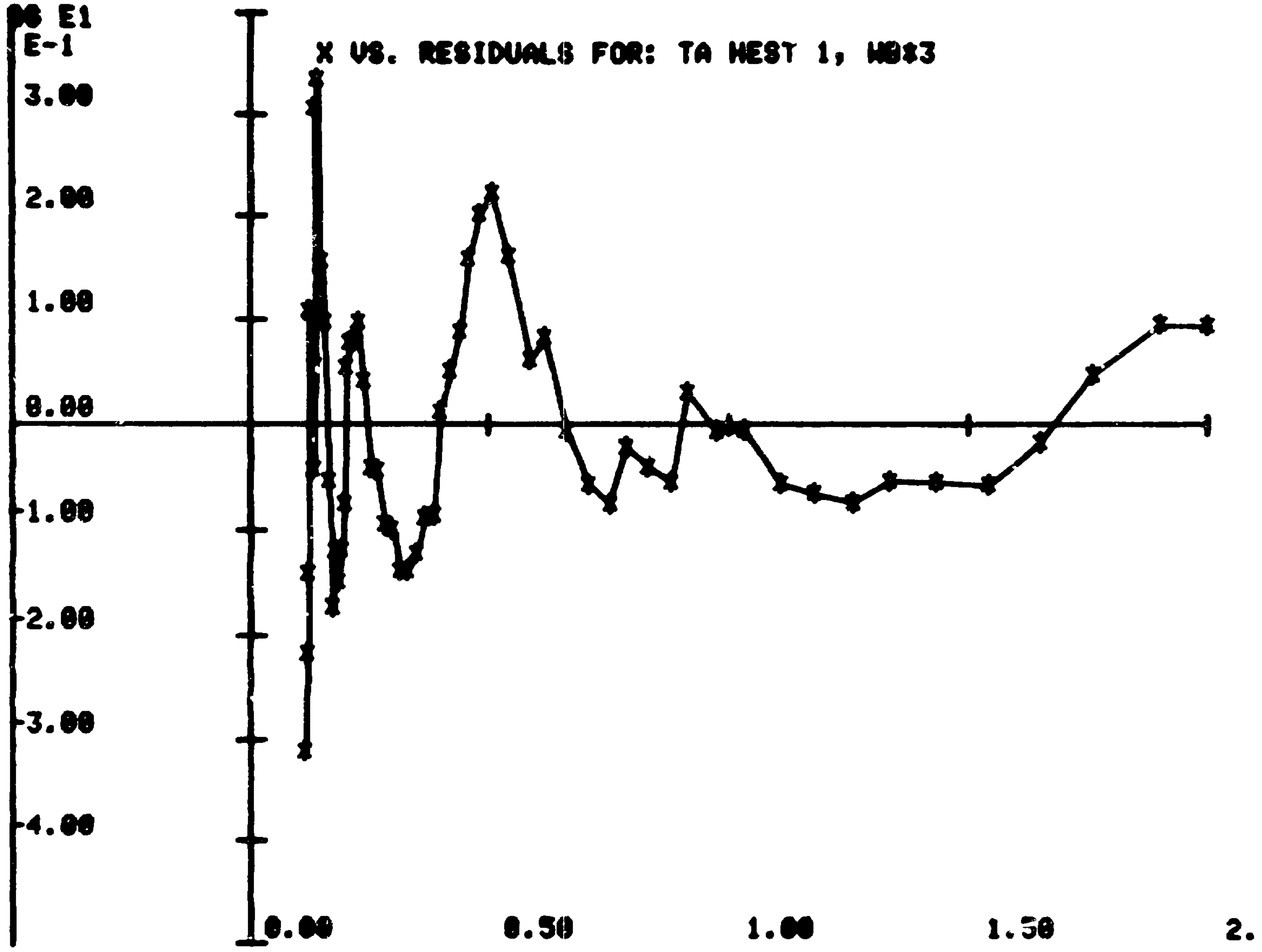
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E-1
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1.50
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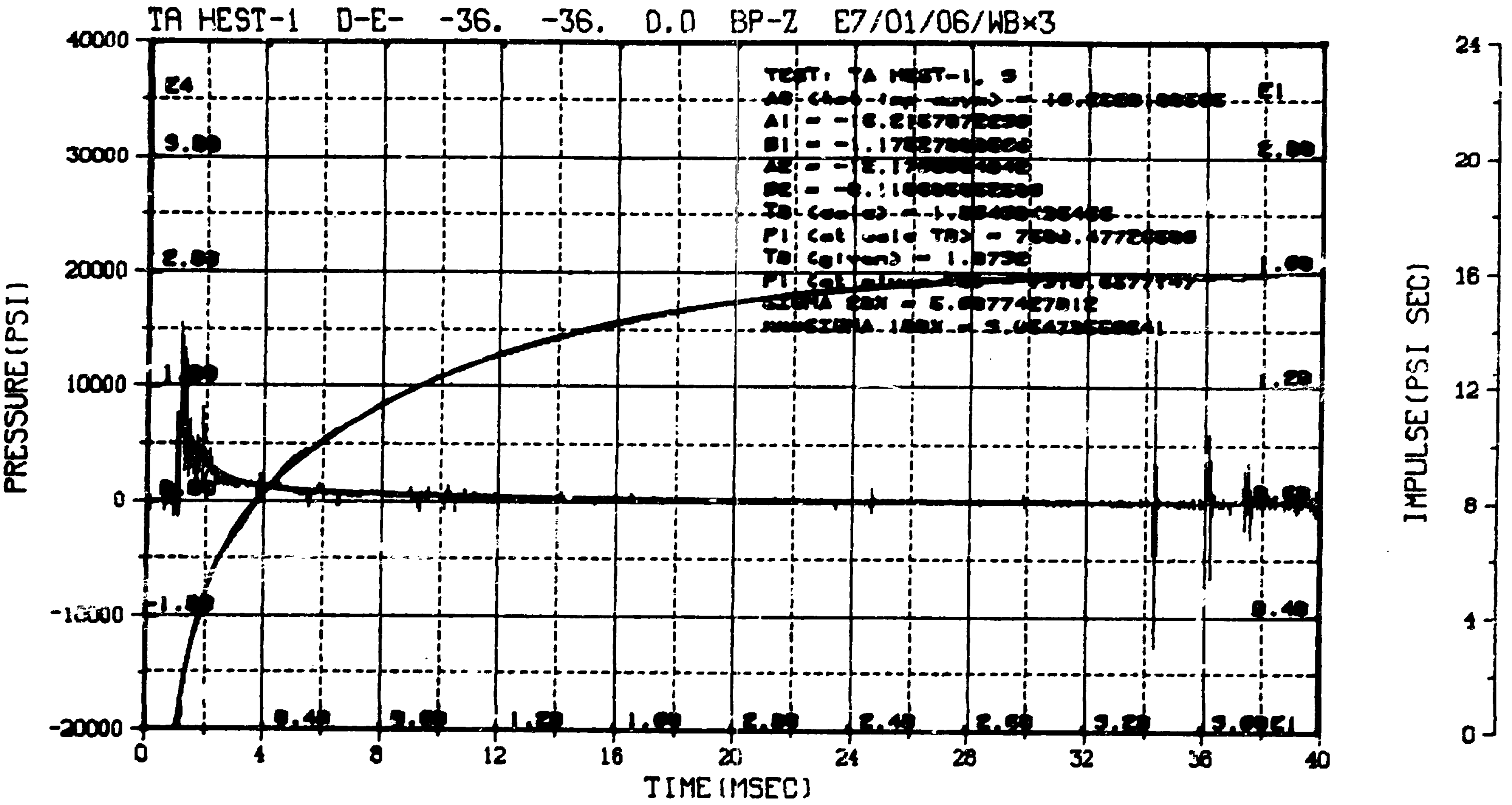

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2 40 PM, 6 MAR 78.

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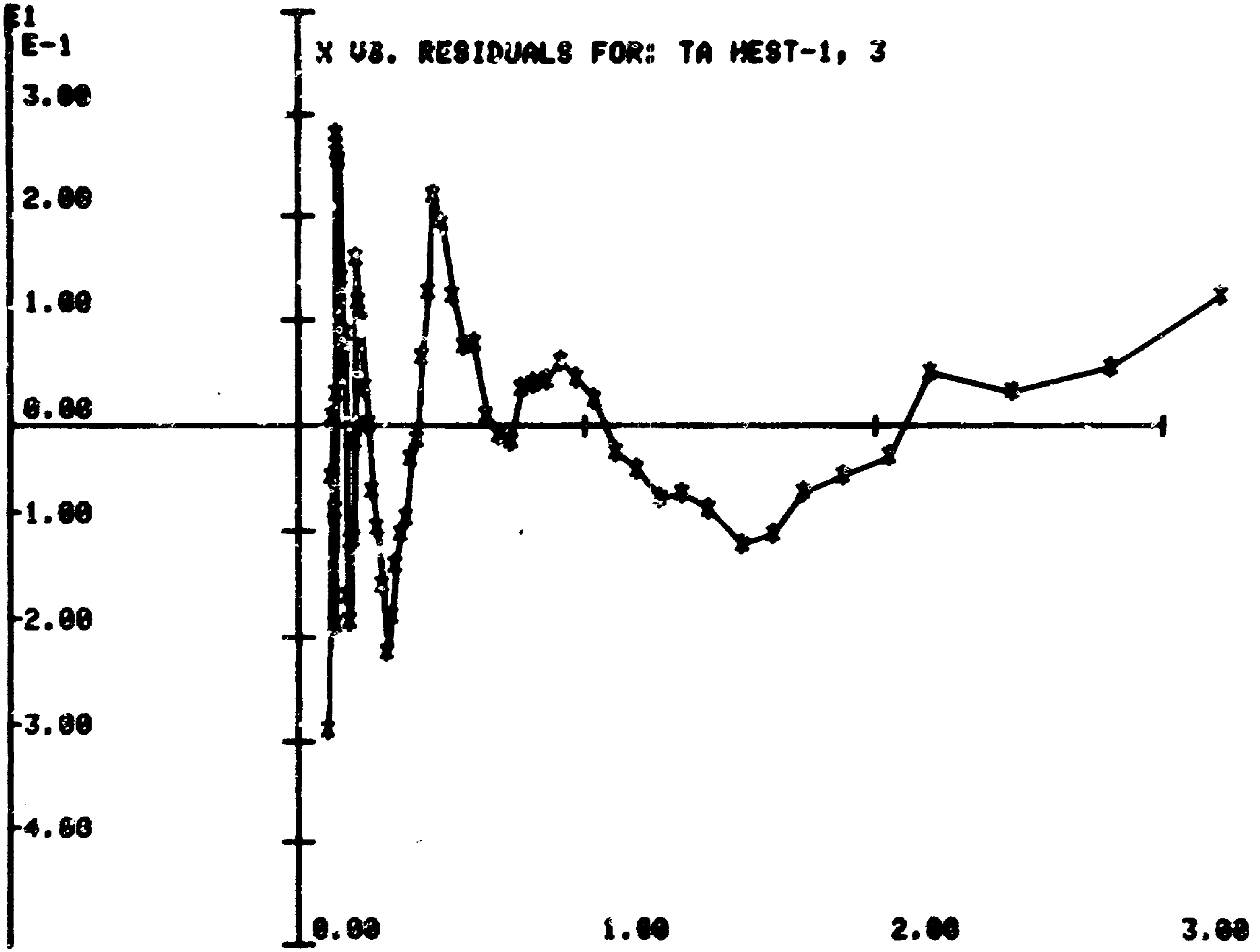
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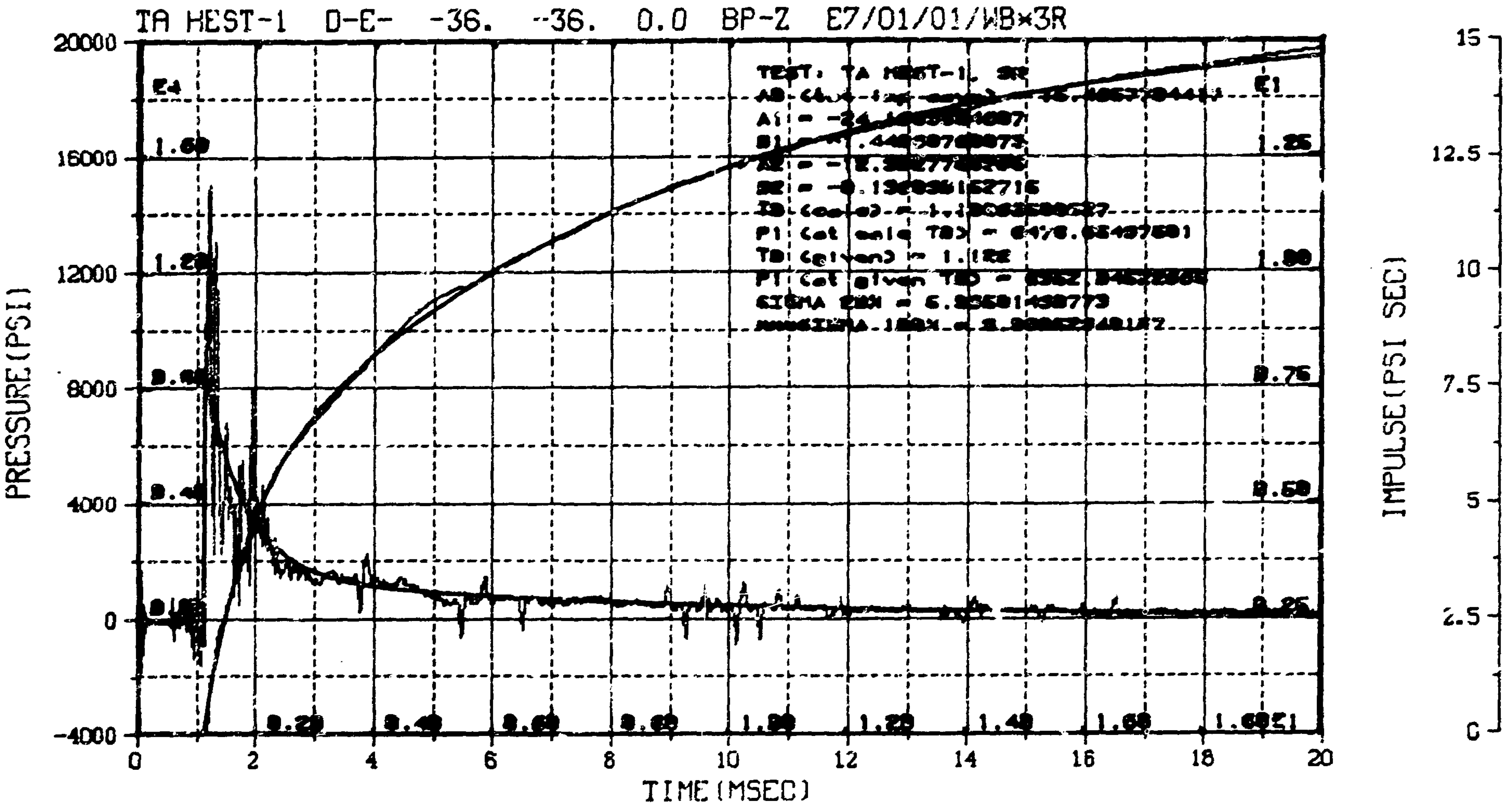

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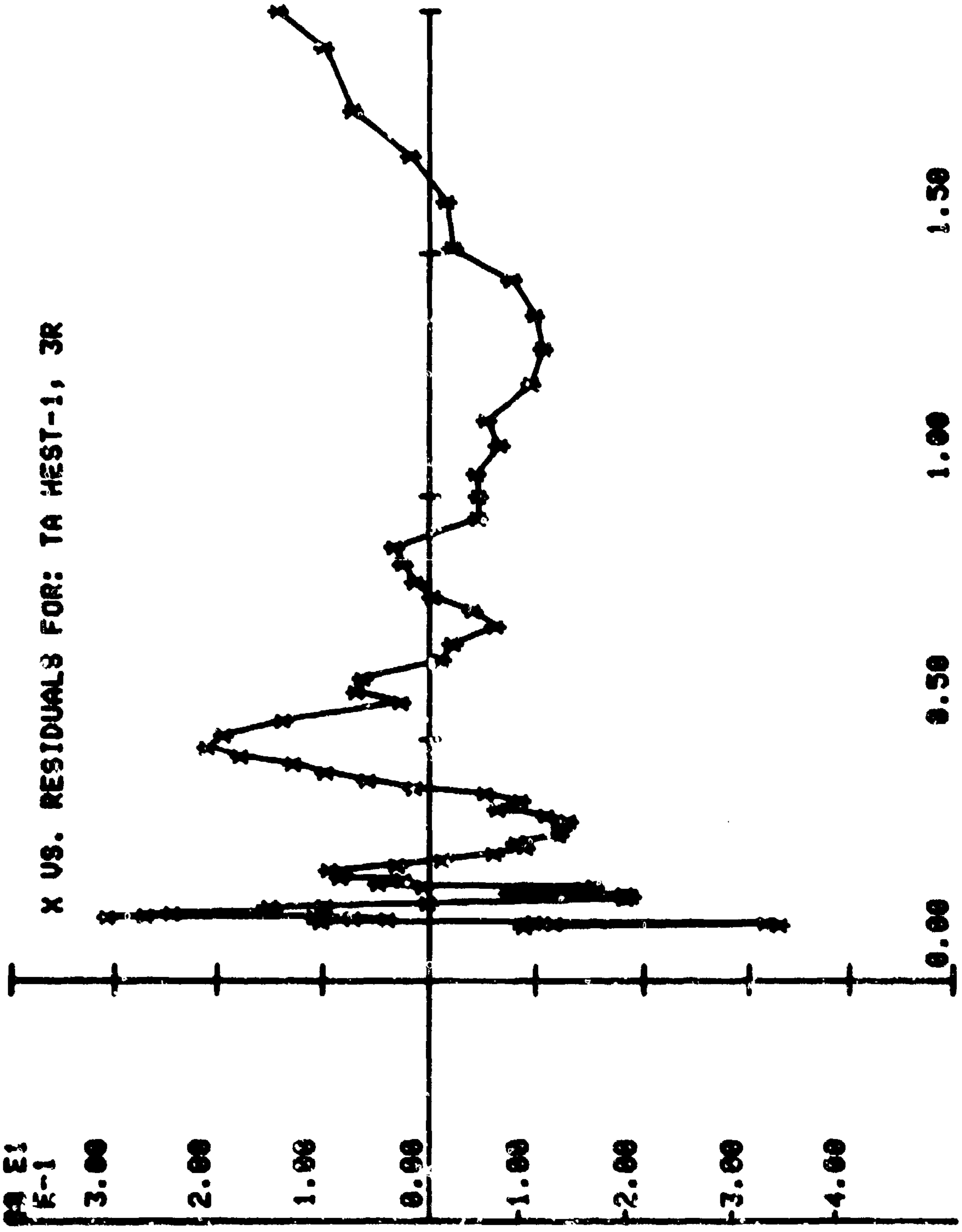
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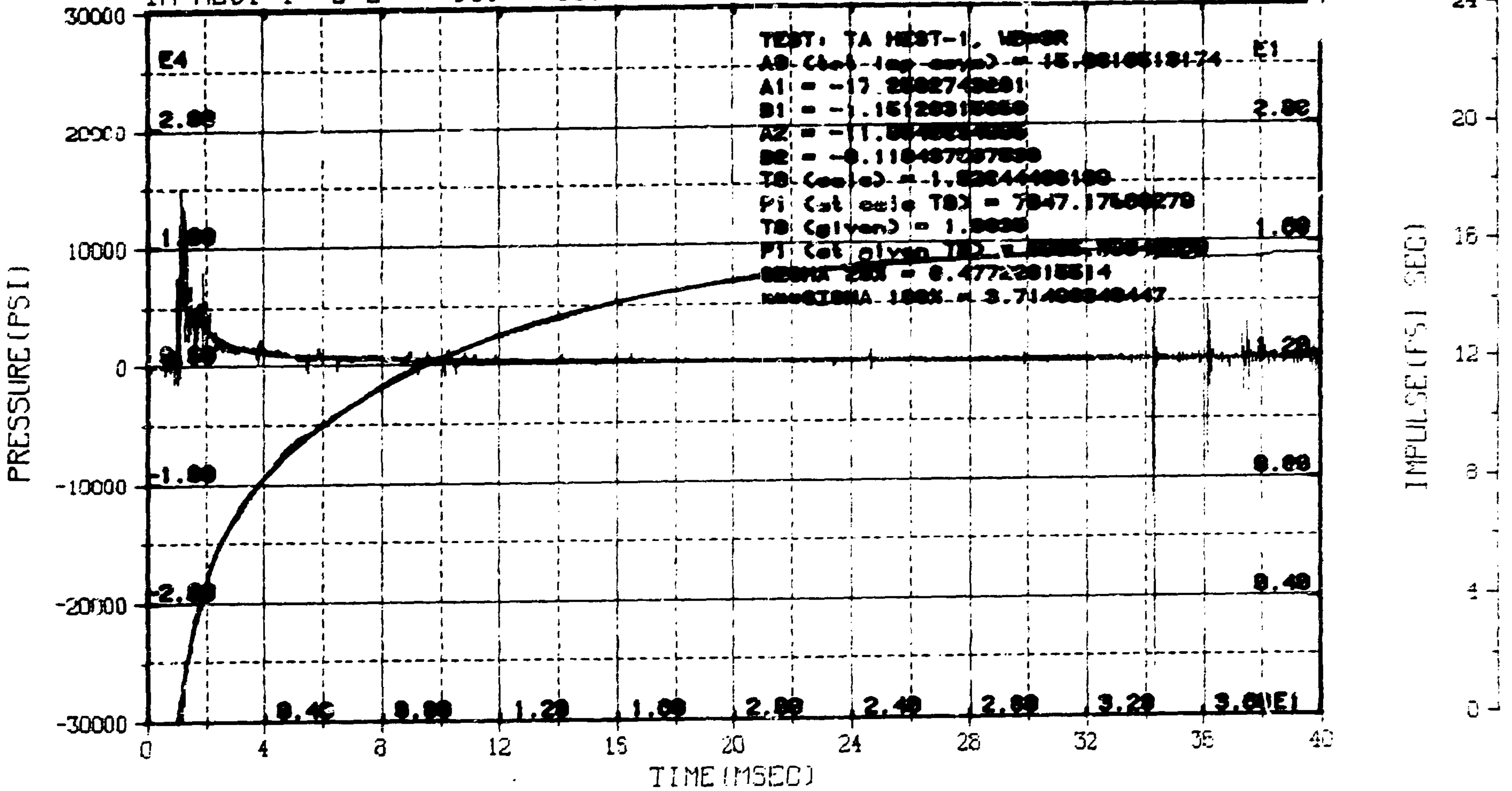

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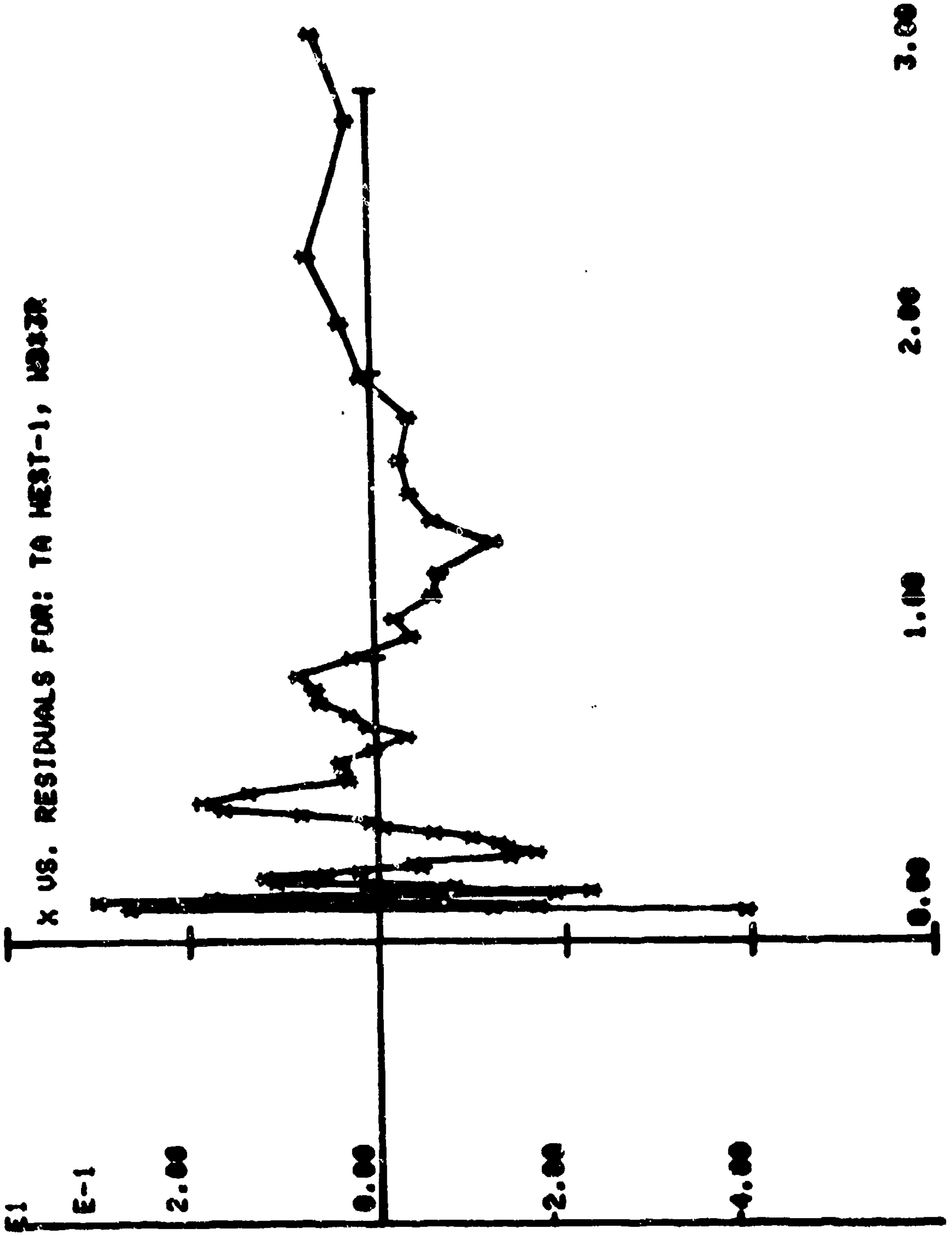
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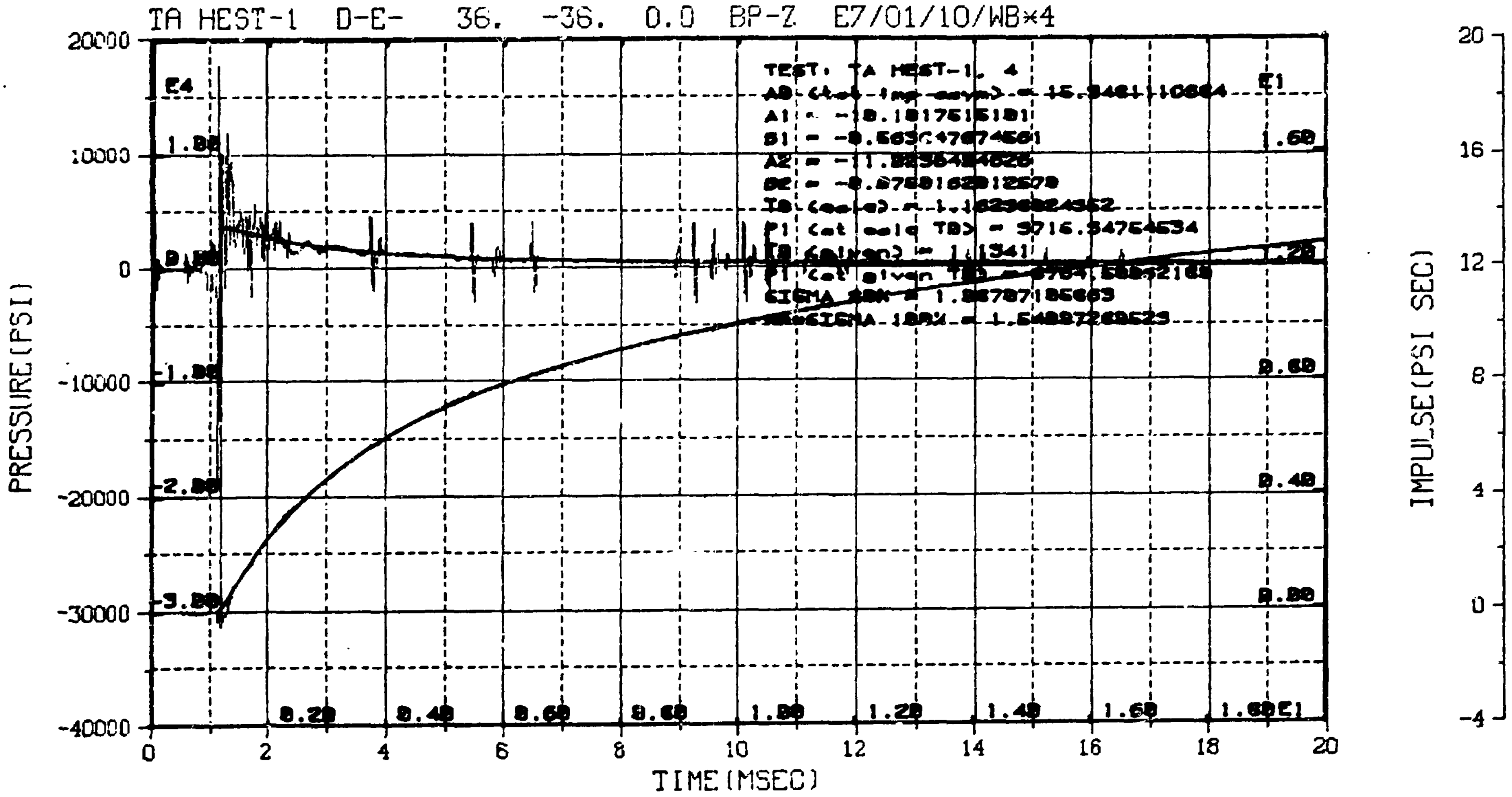

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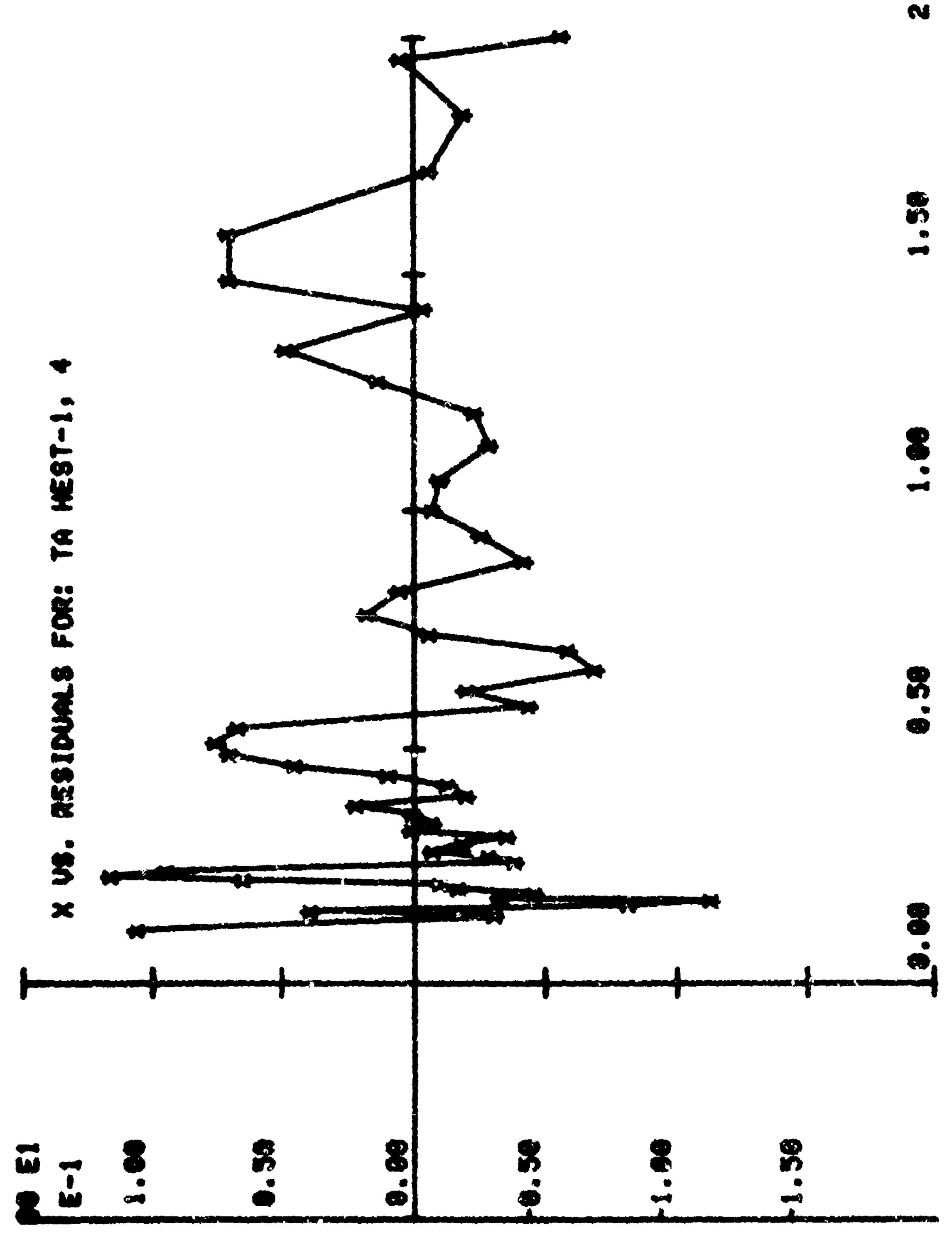

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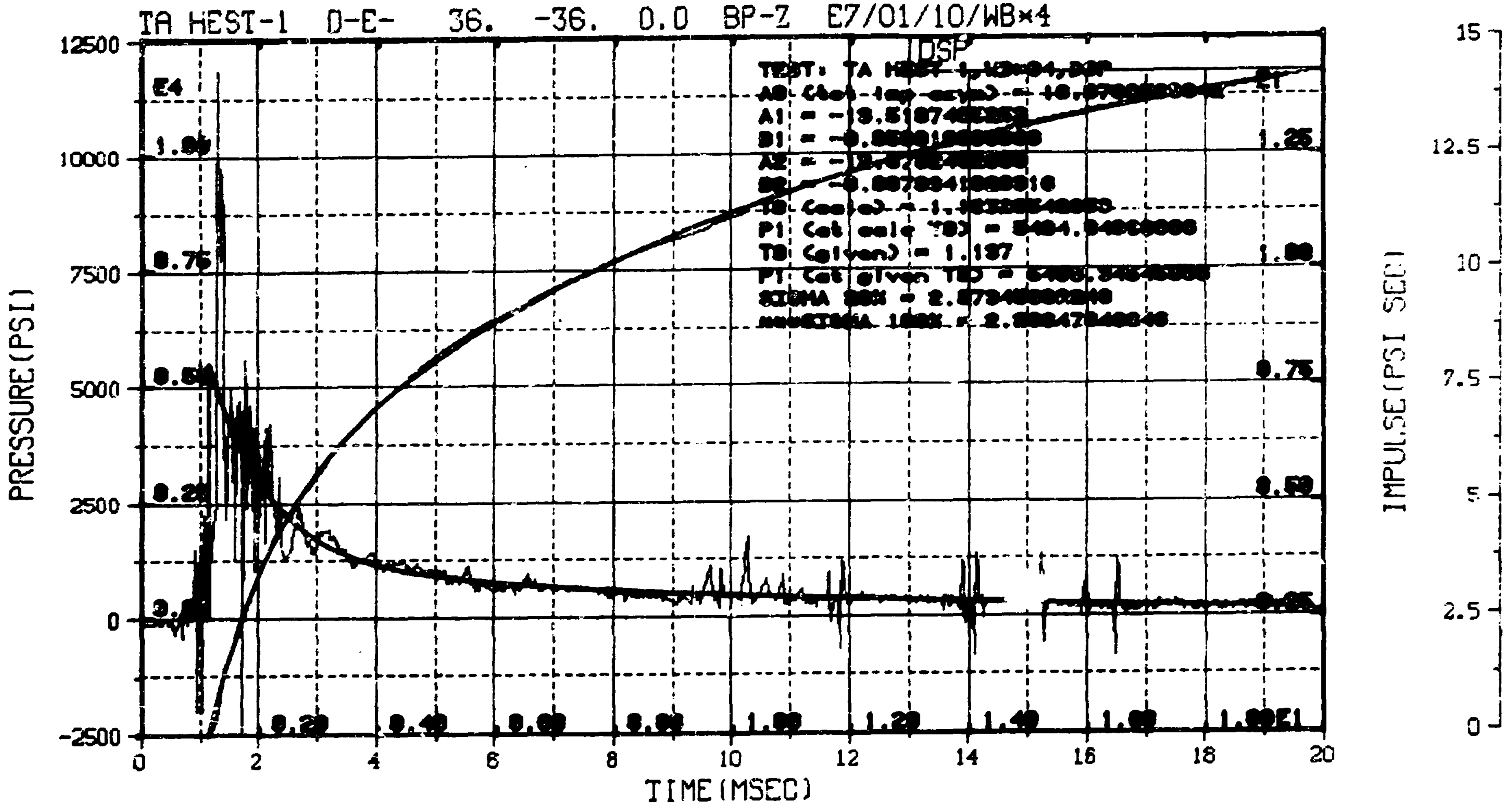

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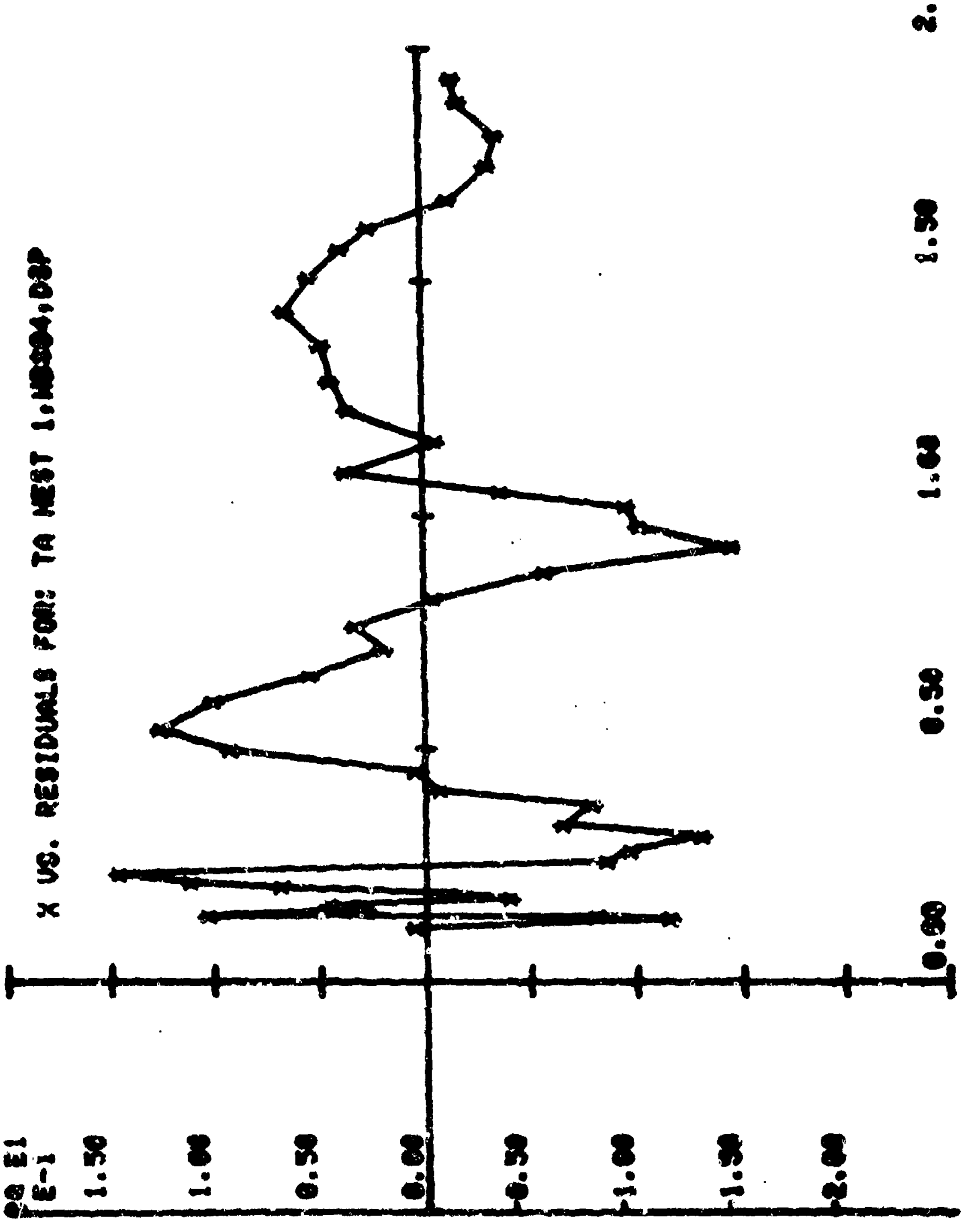
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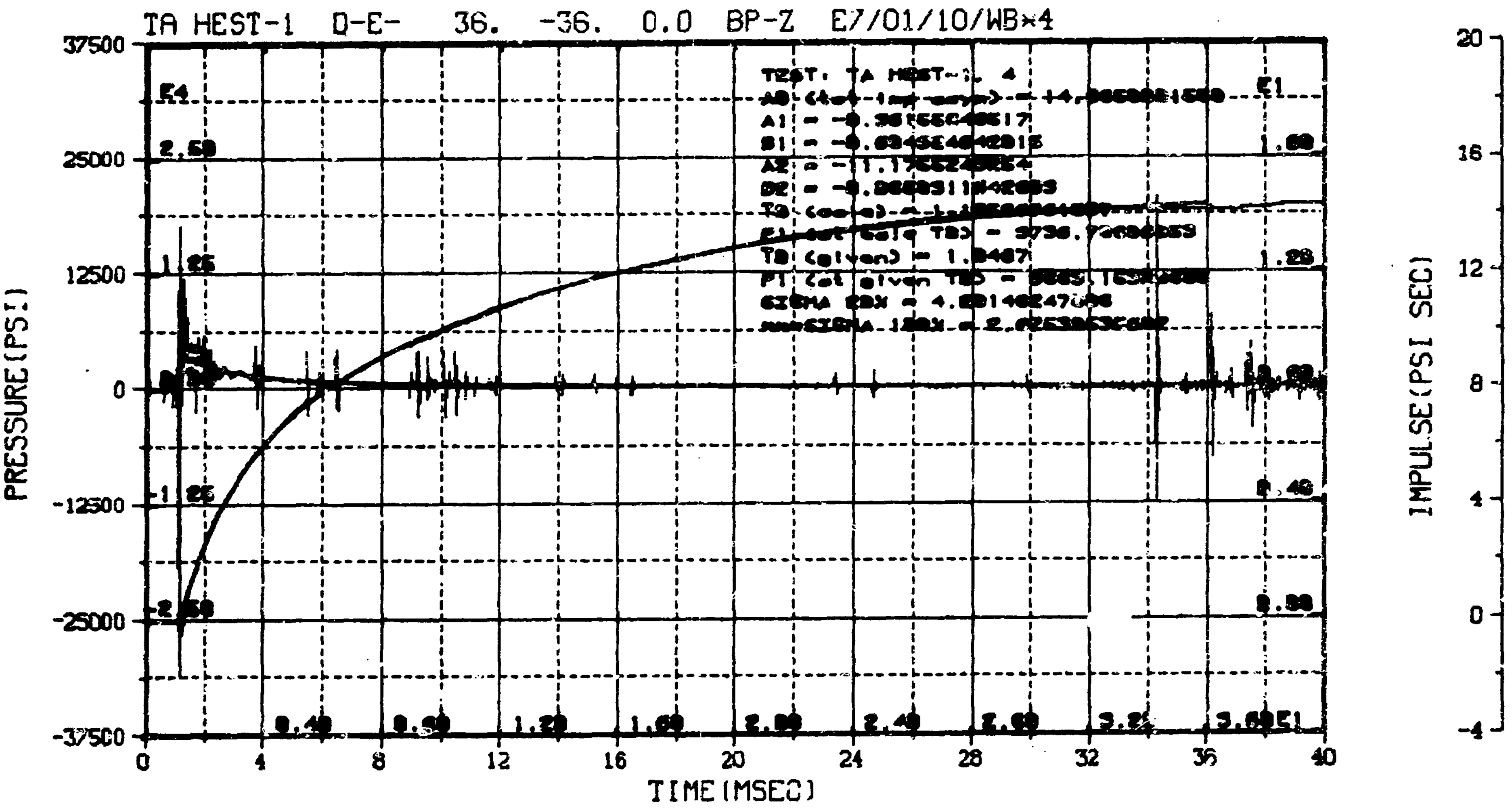

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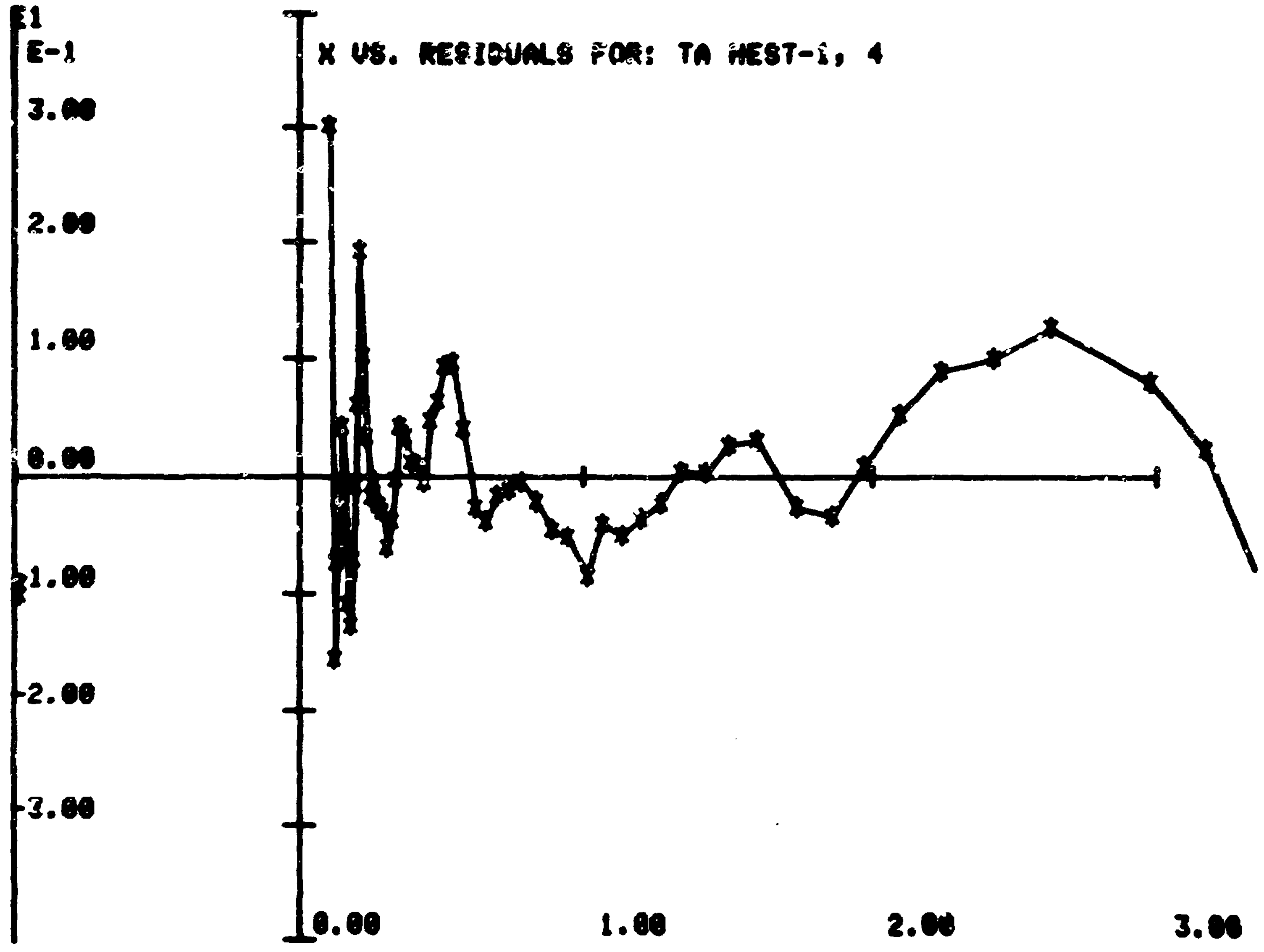
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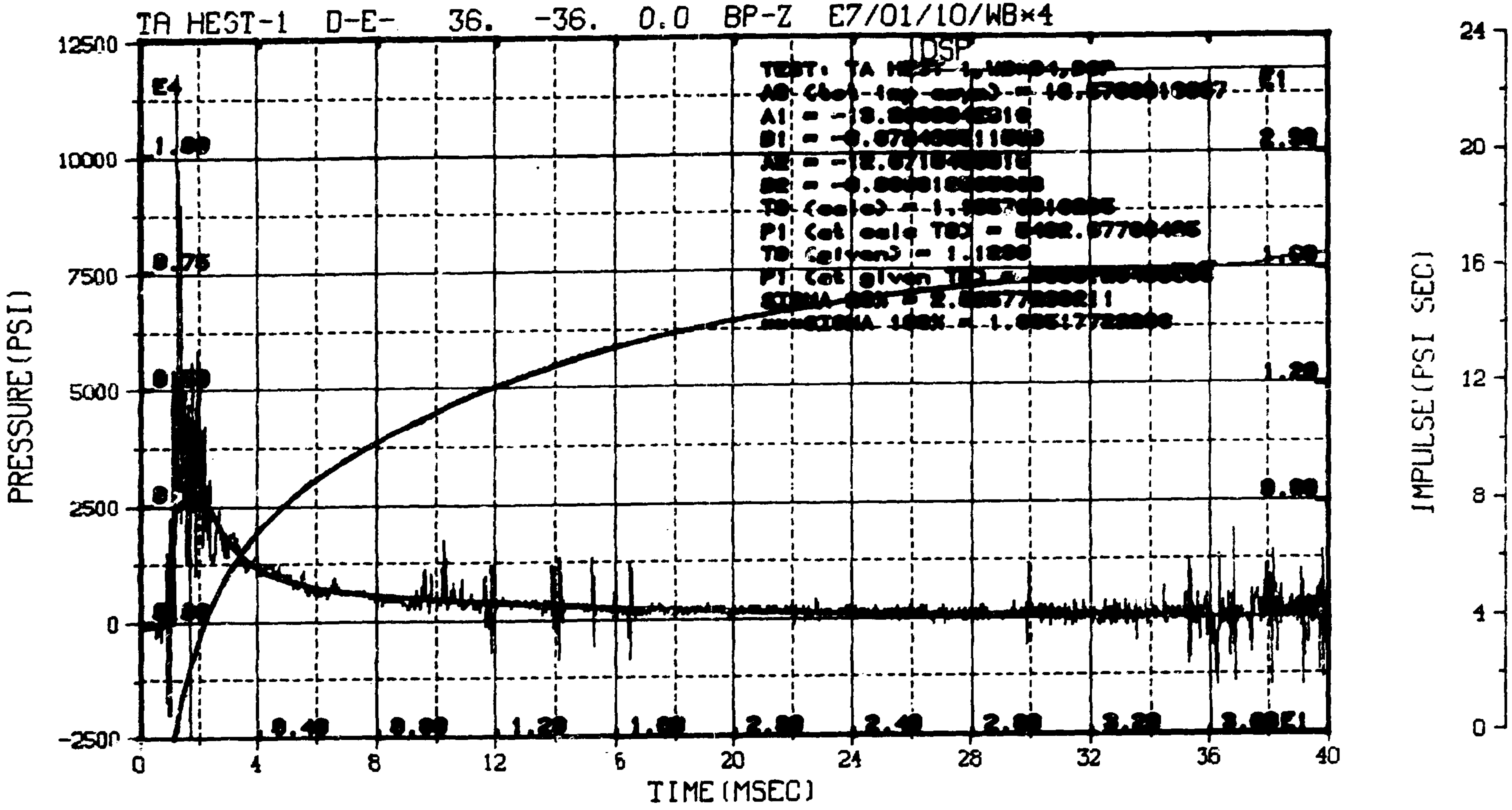

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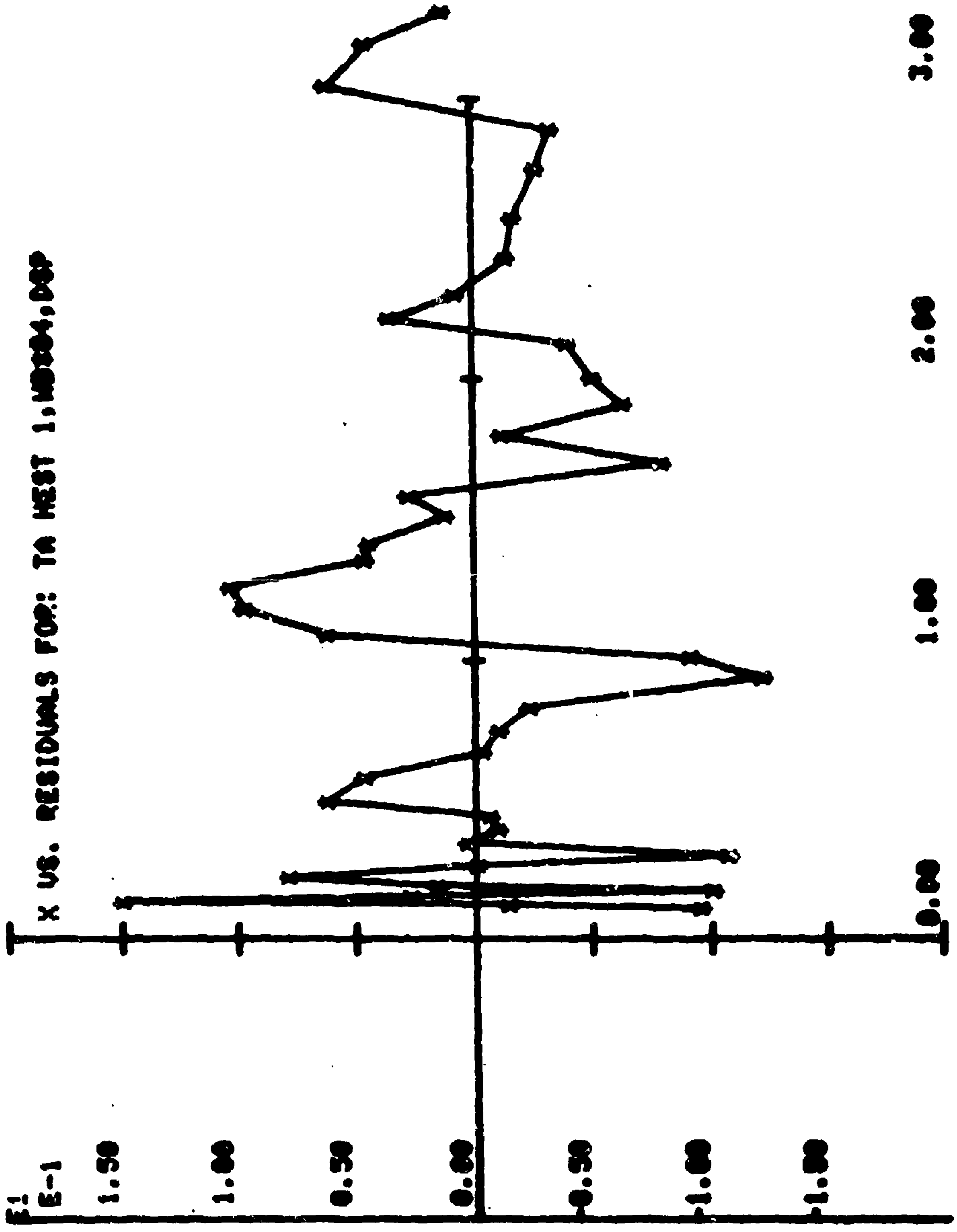
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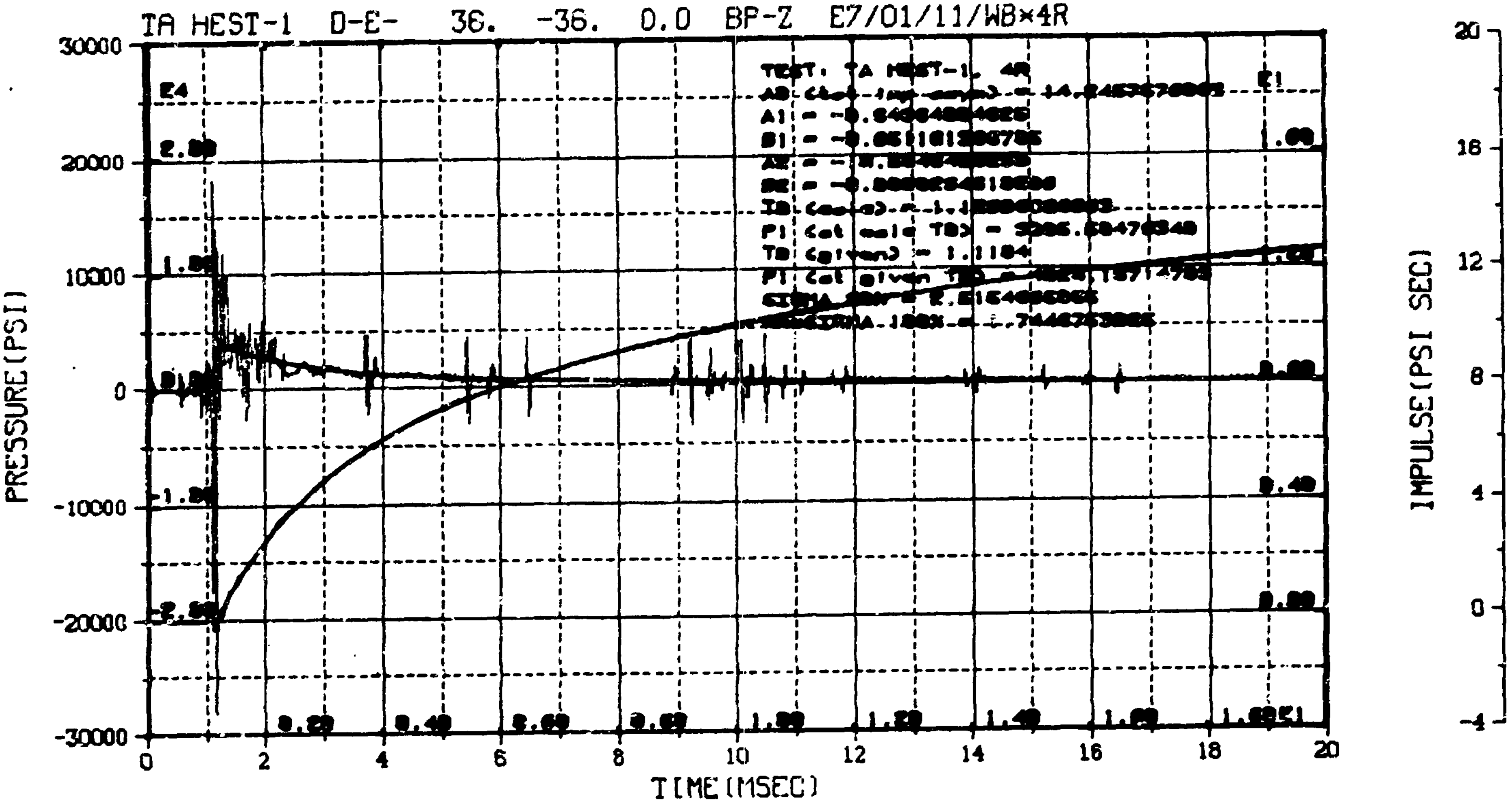

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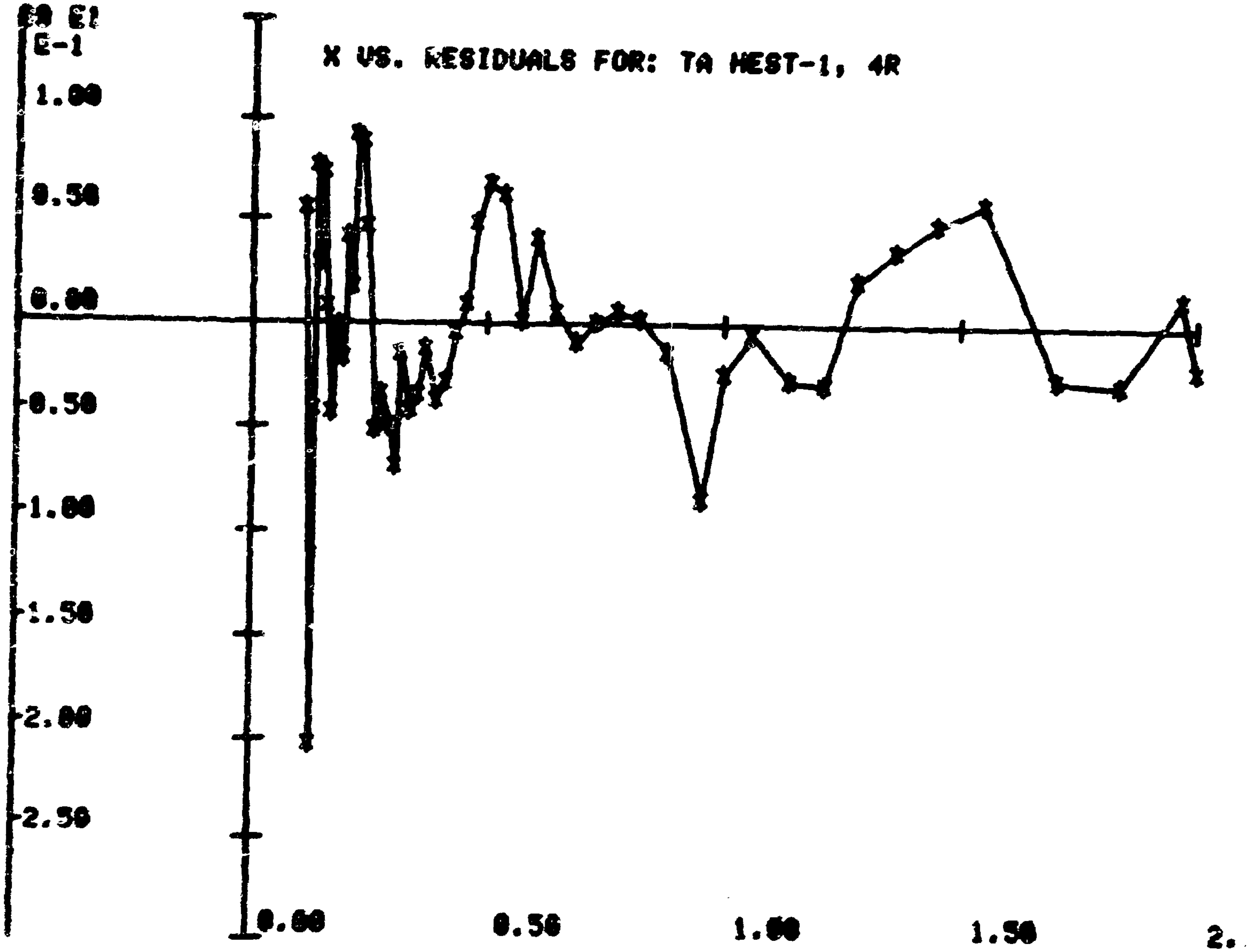
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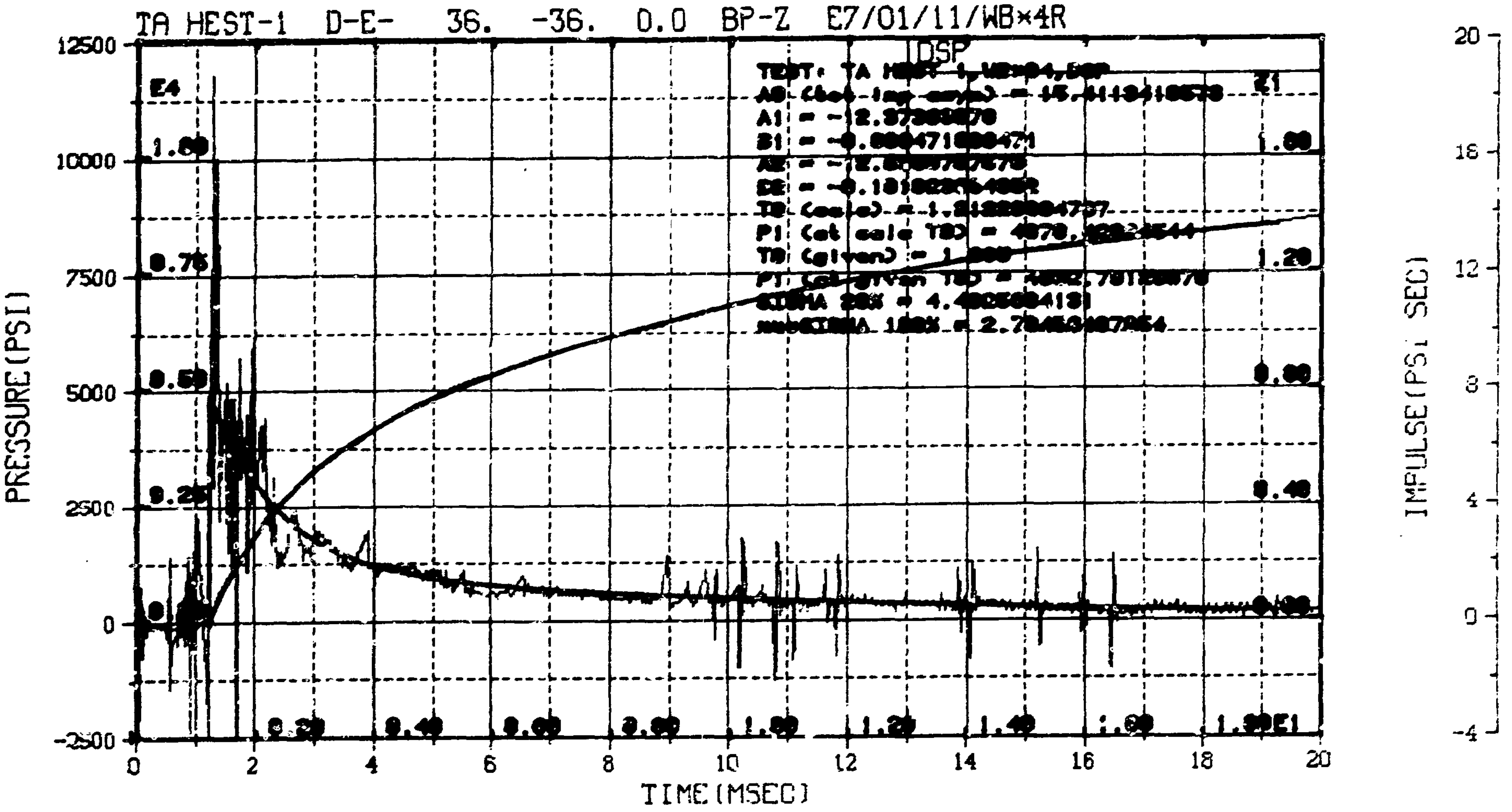

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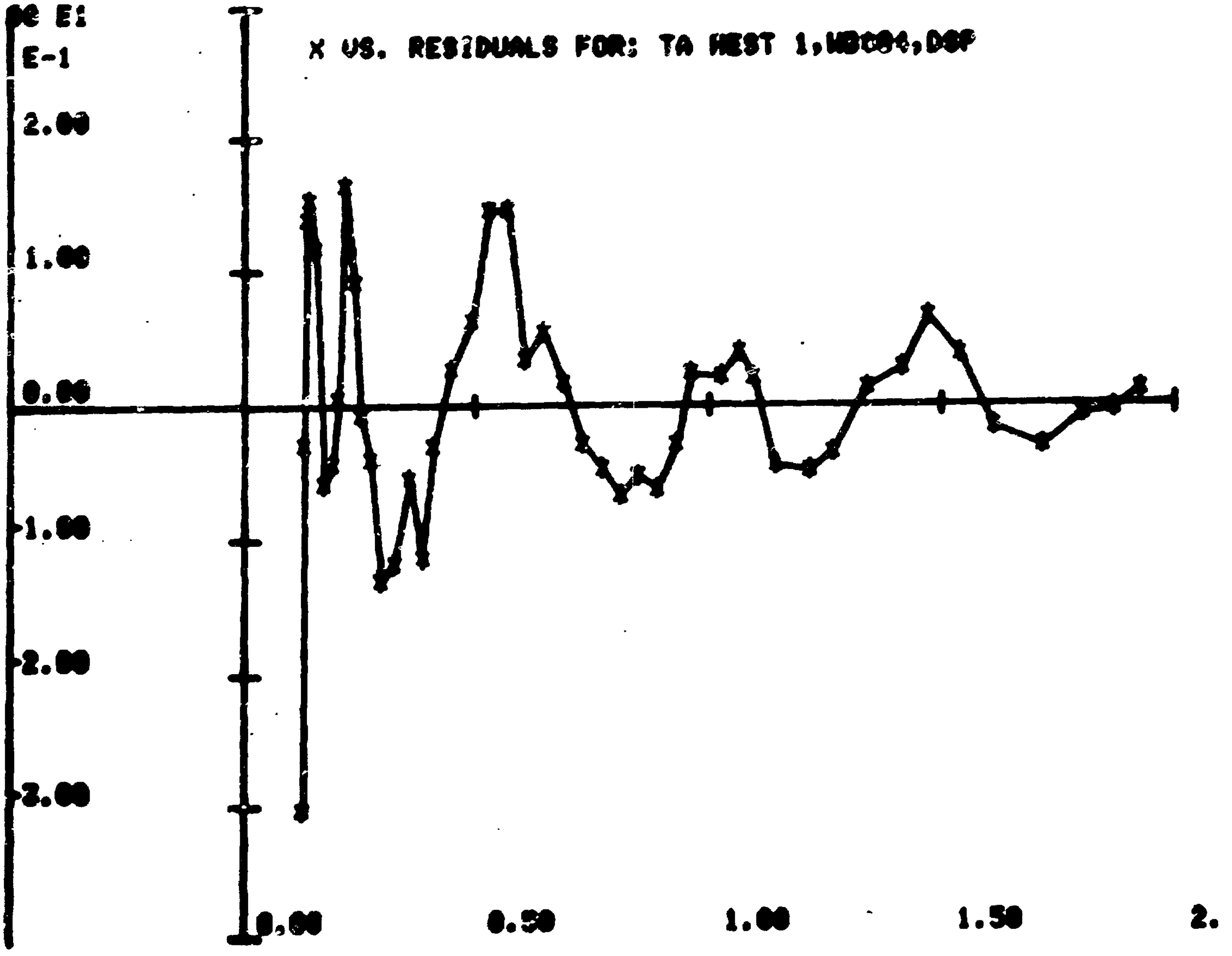
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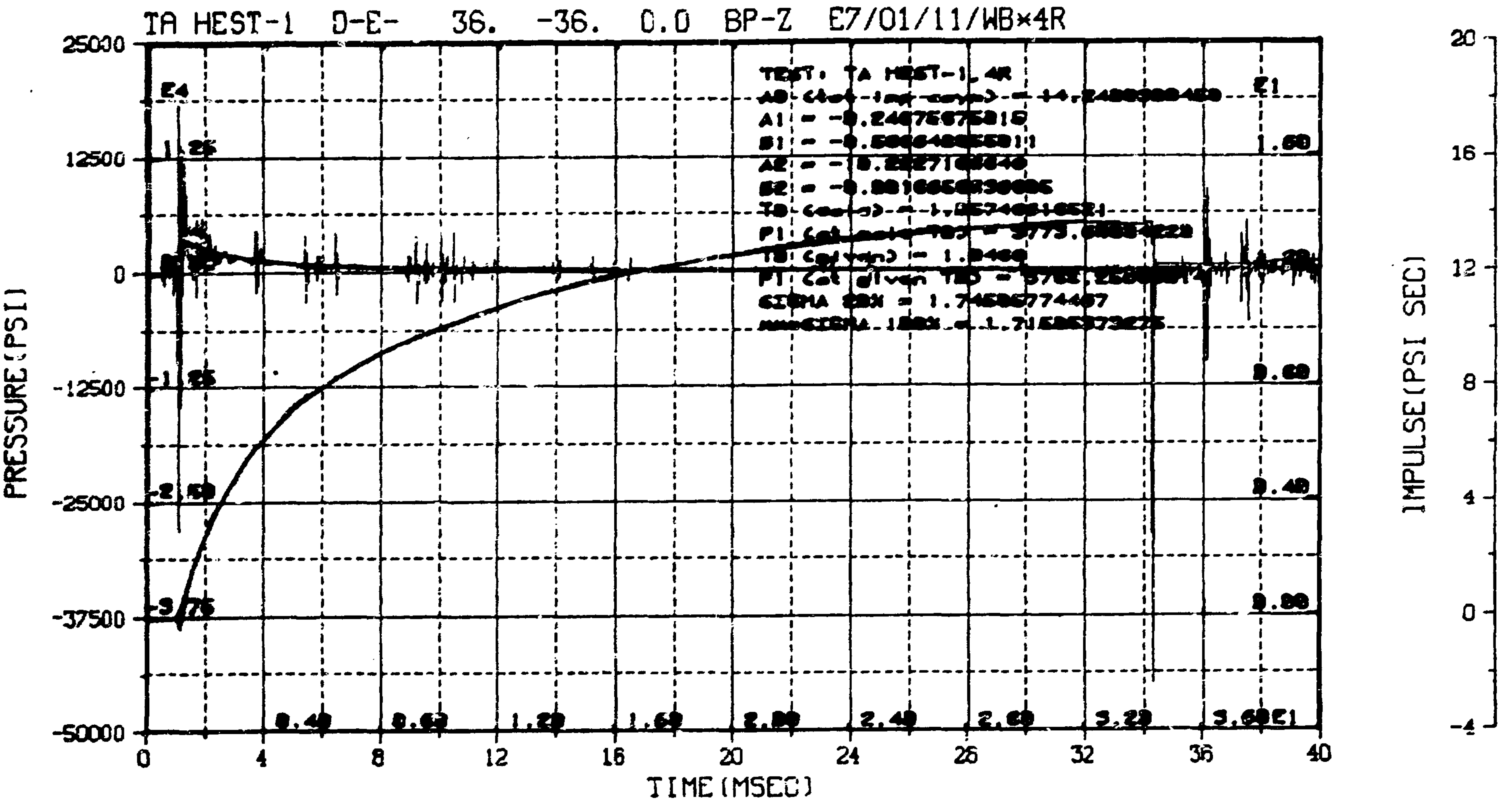

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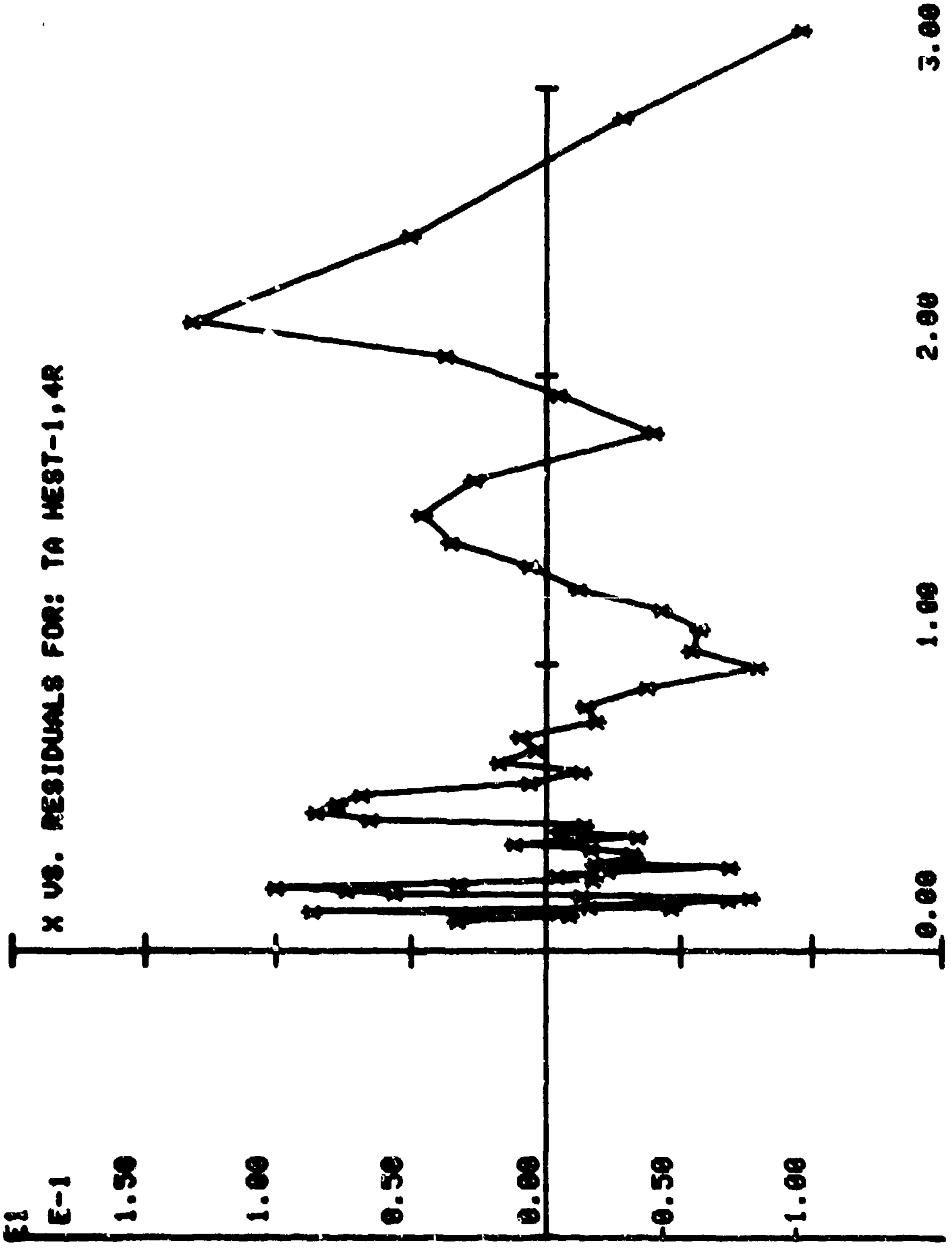
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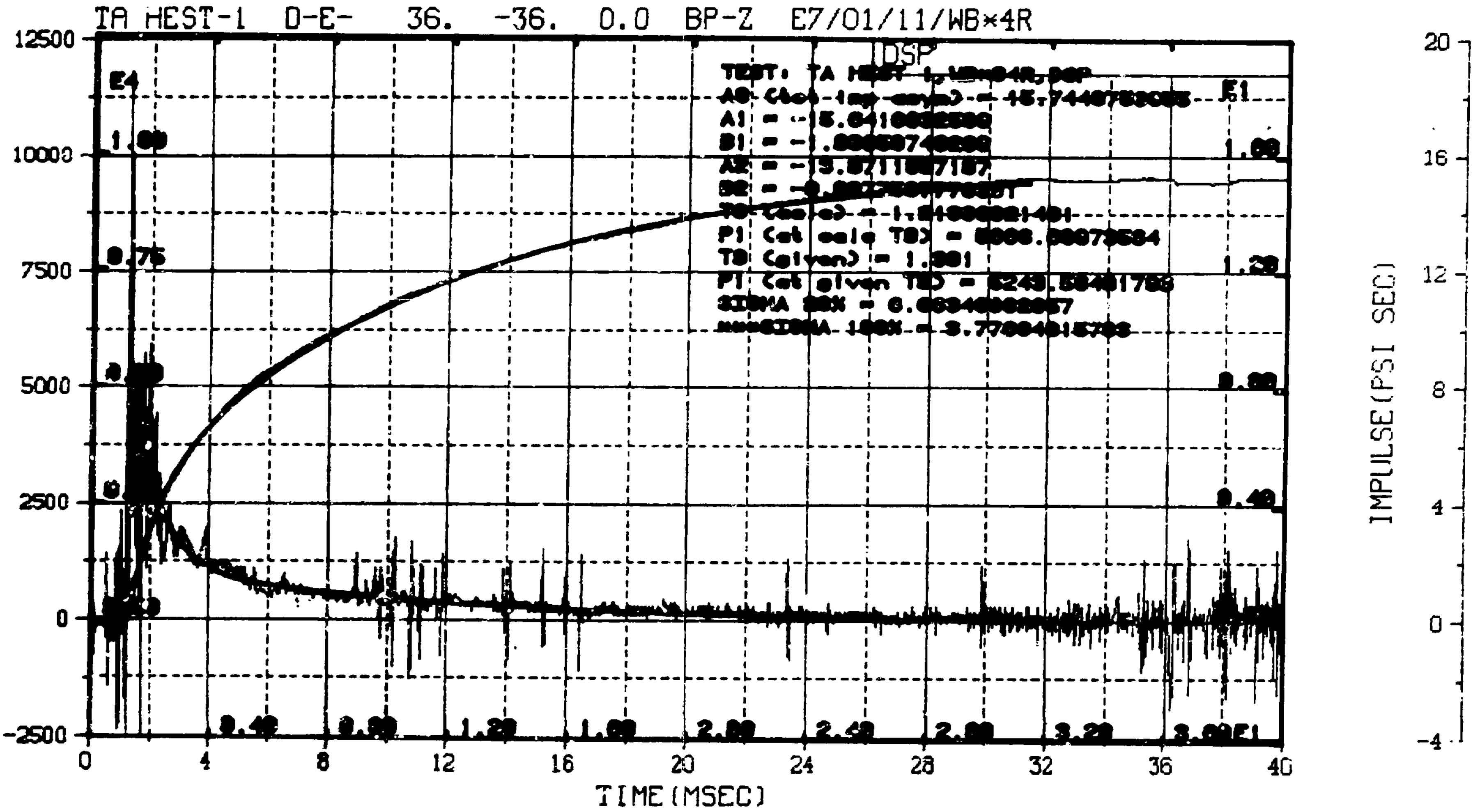

M.N. =80004
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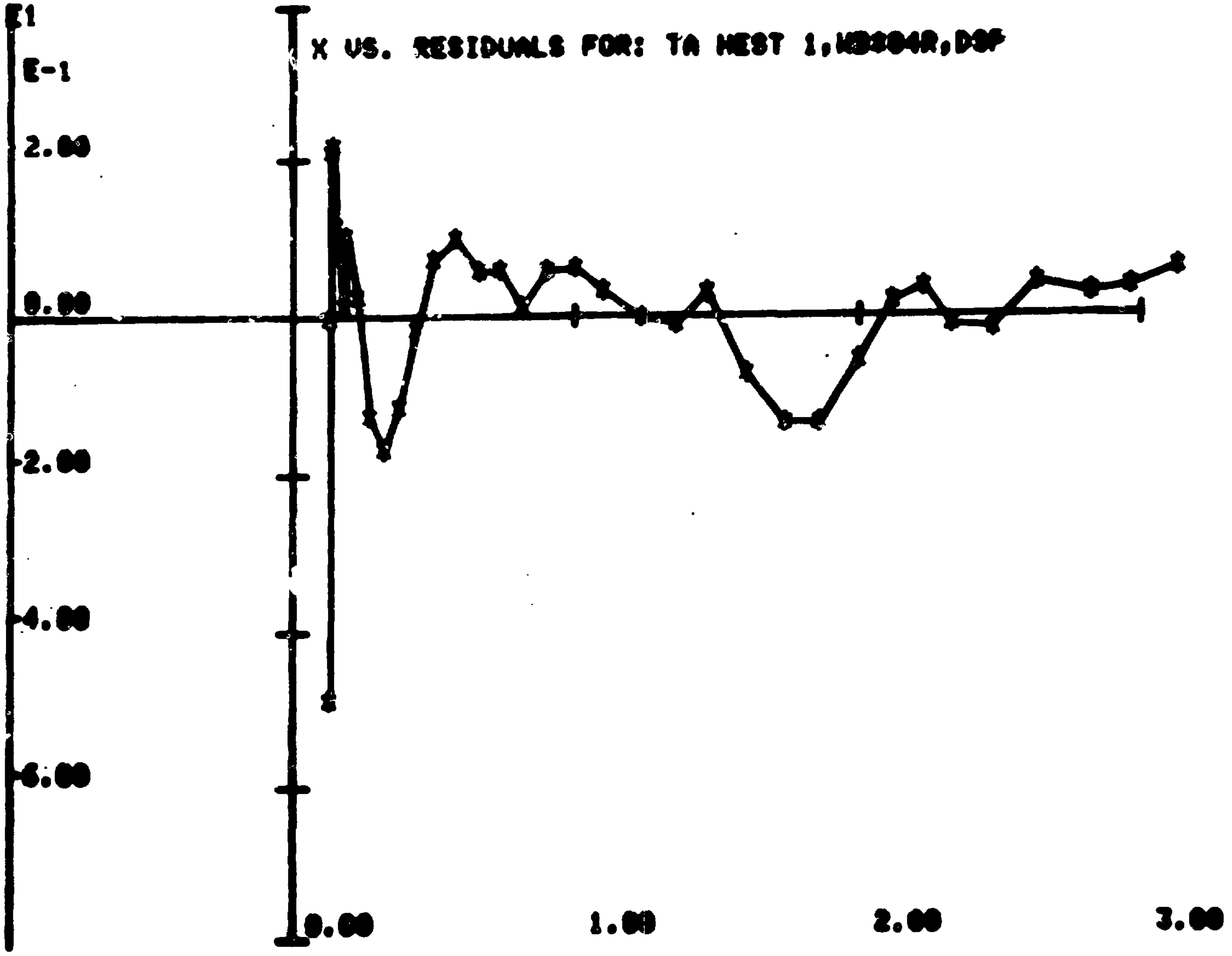
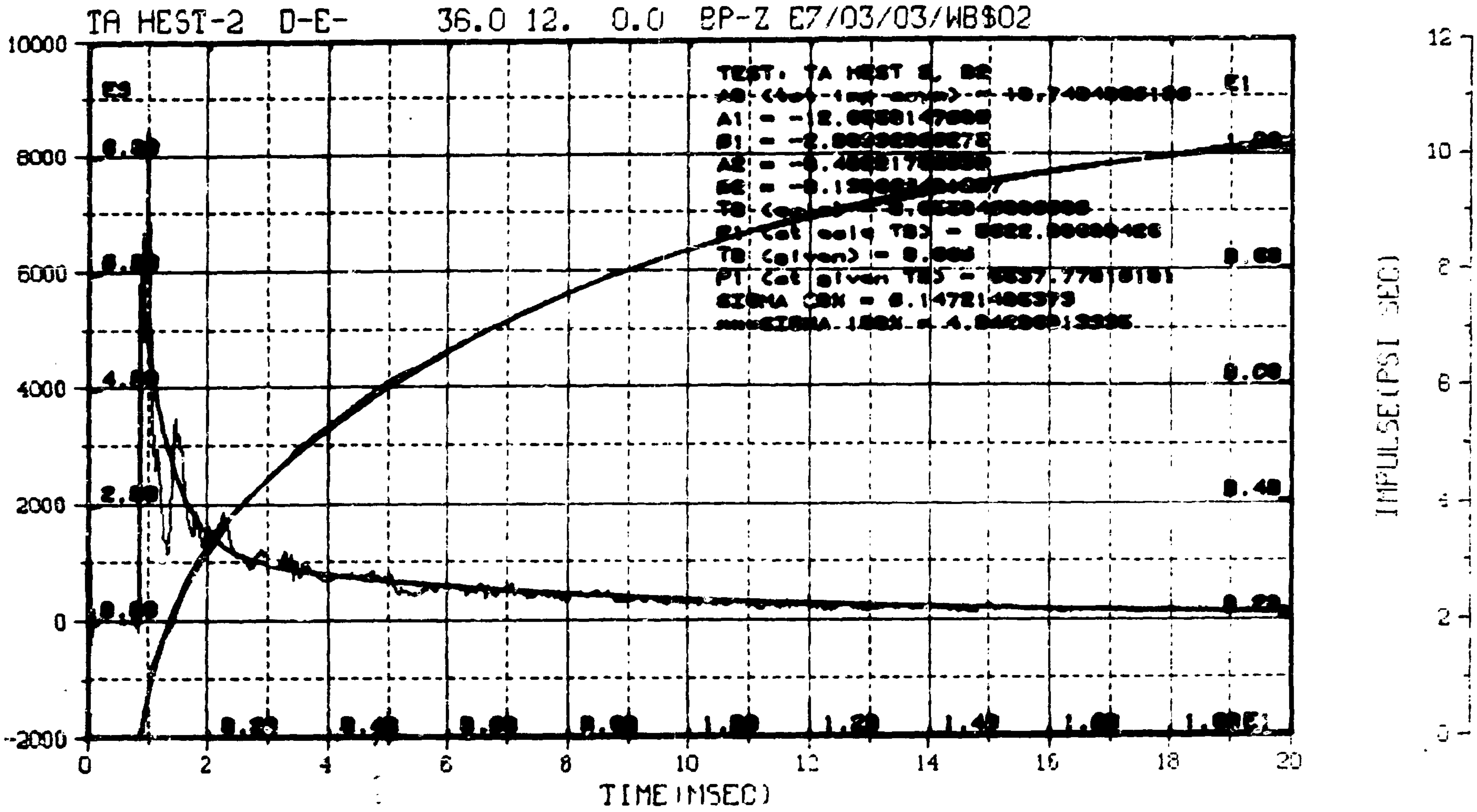
S.R. =50.00 KHZ

E.U. =0.000,28698.000
DIGITS=0.000,1308.875
3 49 PM, 11 APR 78.

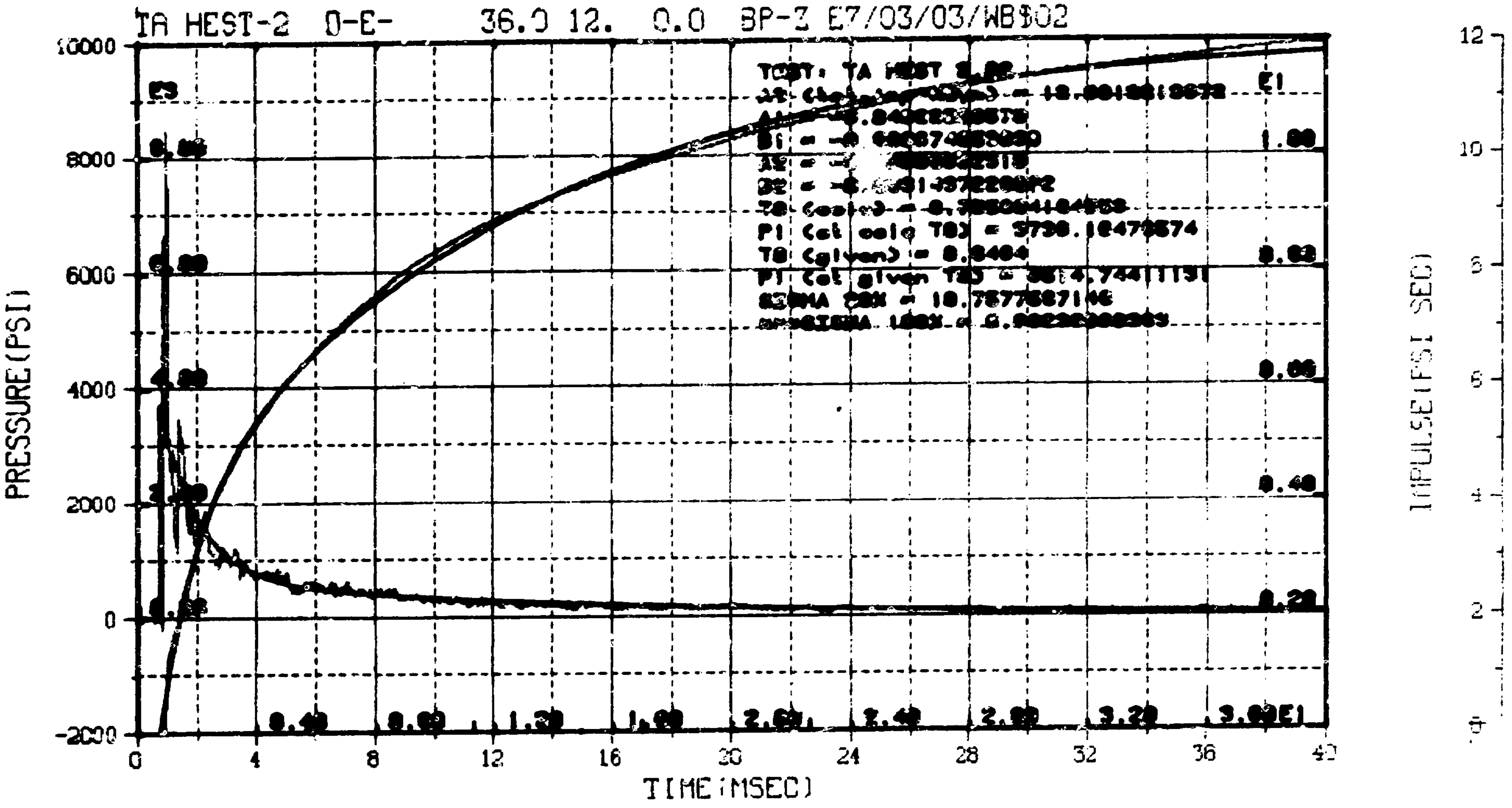
VSN=
TAPE26
FILE=4

1

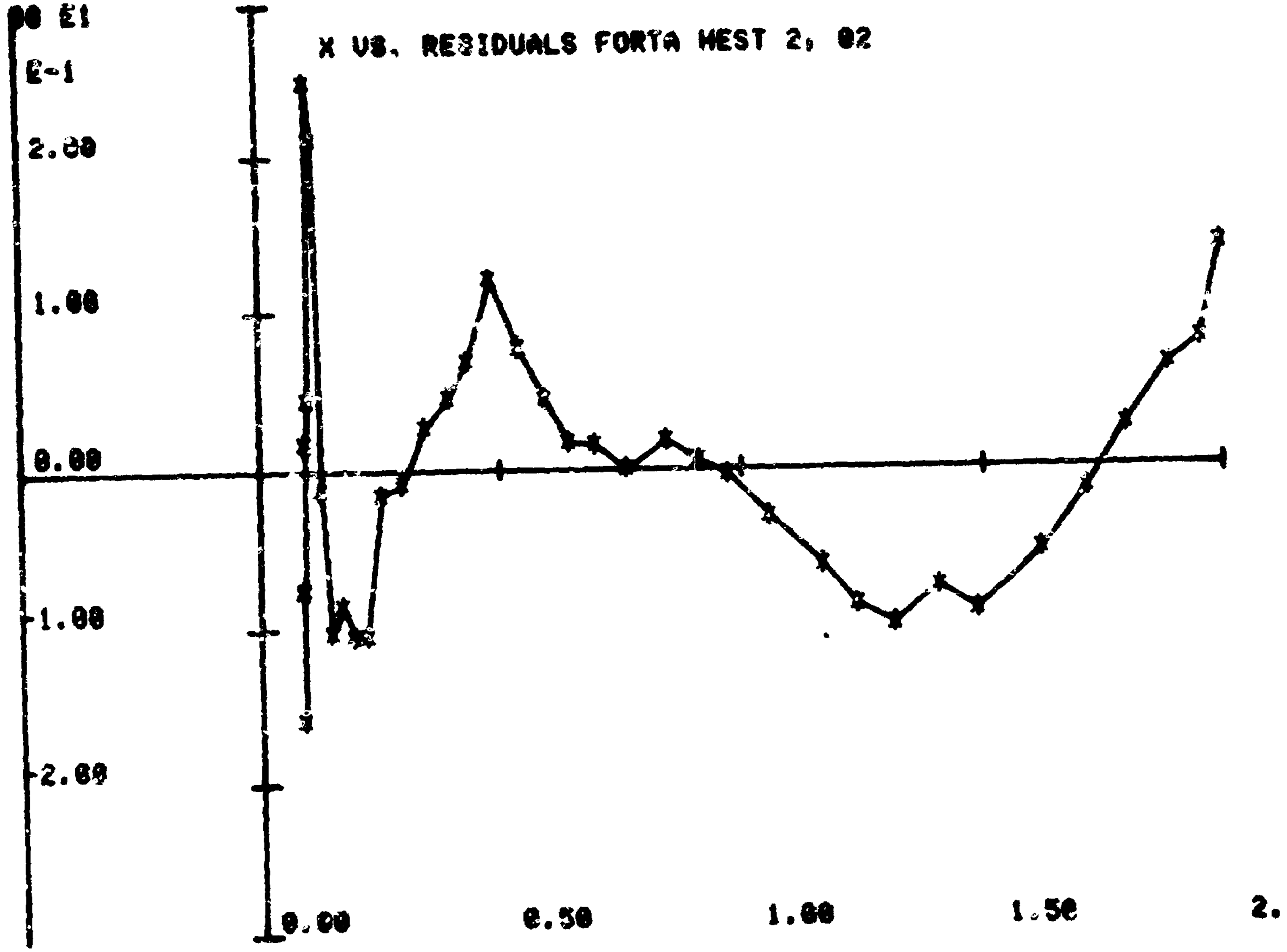

X VS. RESIDUALS FOR: TA WEST 1,WD004R,DSF
E1
E-1
2.00
0.00
-2.00
-4.00
-6.00
0.00
1.00
2.00
3.00

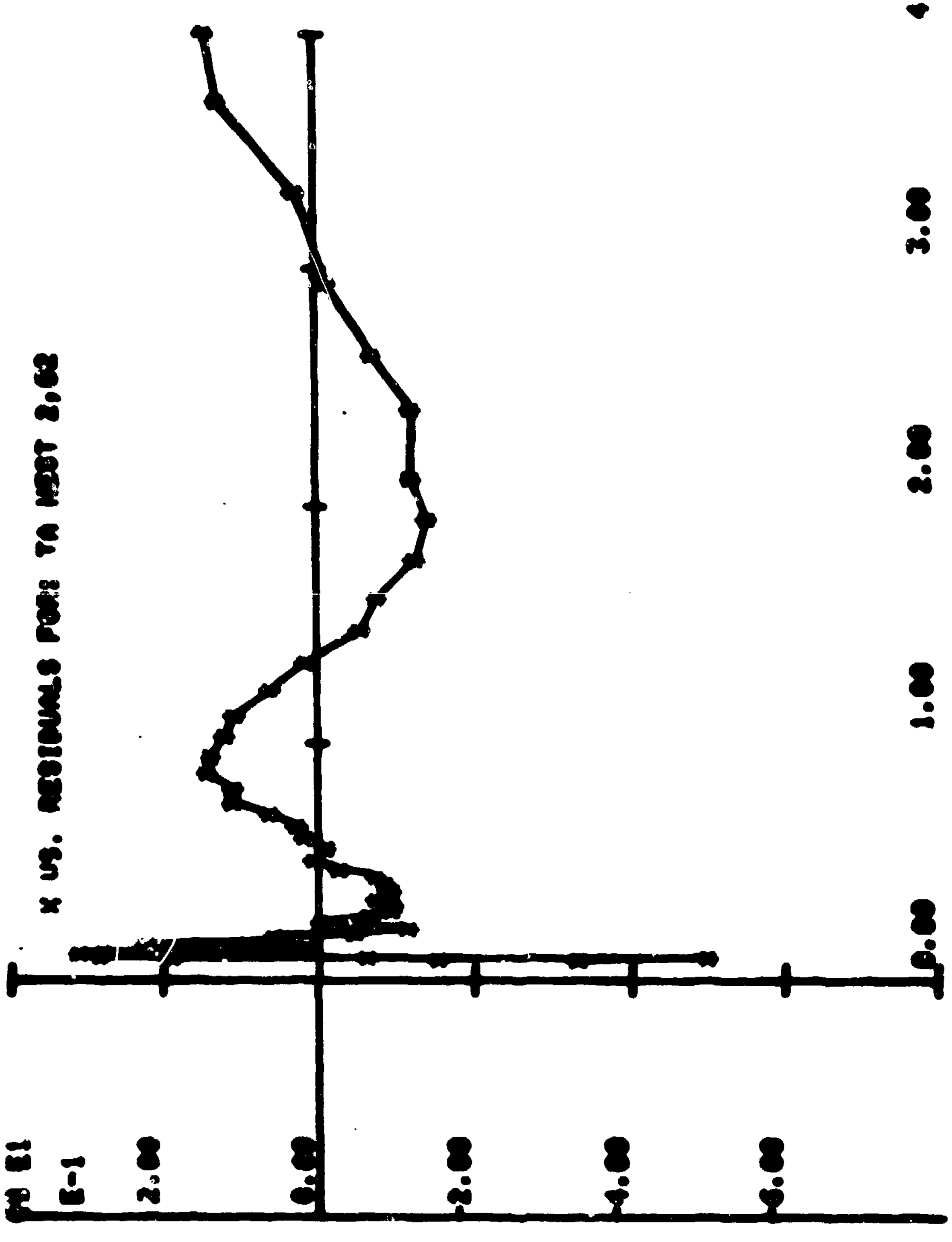


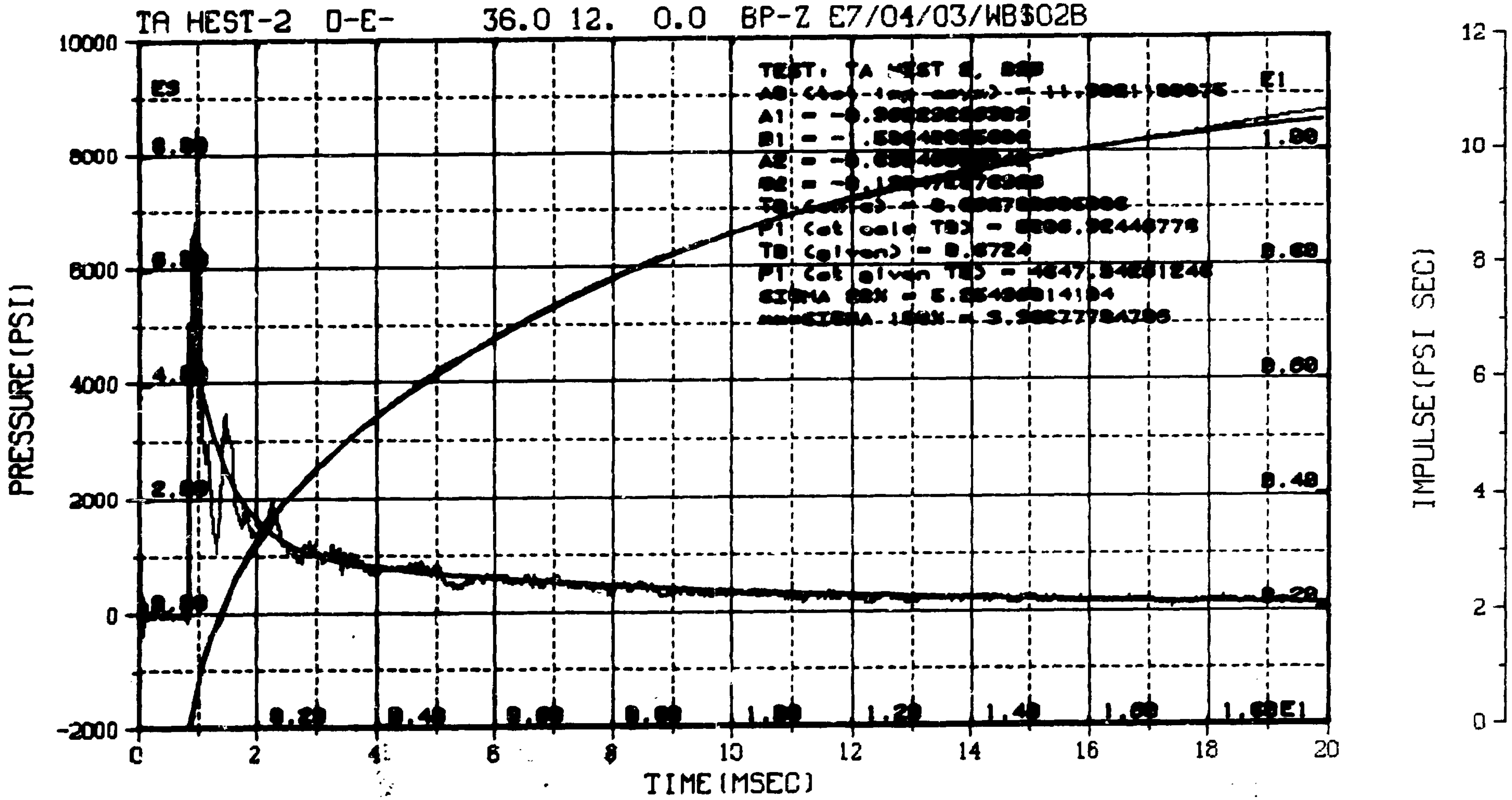
```
M.N. =      2          E.U.  =0.000,5117.900      VSN=
TSKIP=15.100           DIGITS=0.000,976.500       TAPE22
S.R. =100.00 KHZ        10 04 PM,28 MAR 78.       FILE=42
```



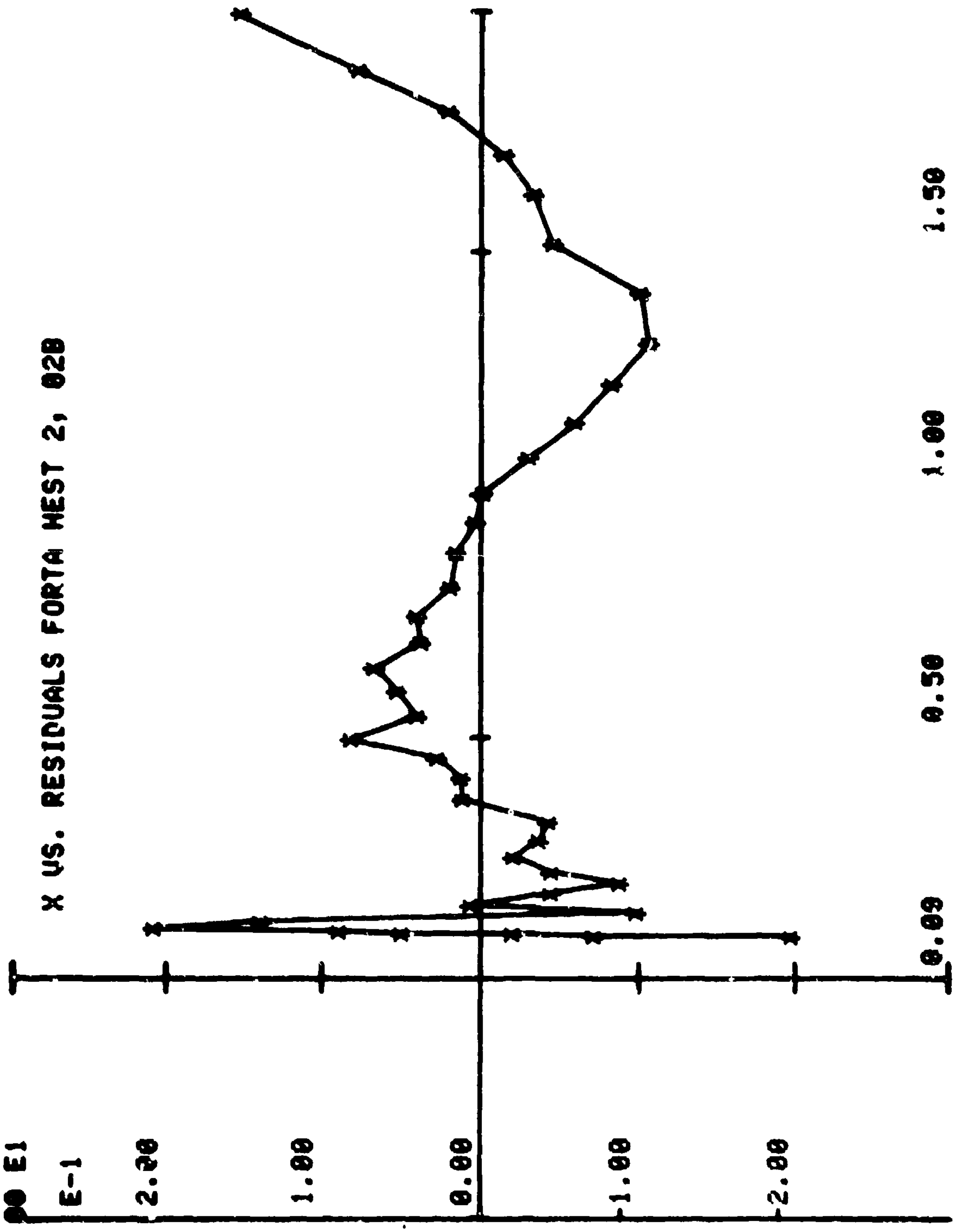
```
M.N. =     2          E.U.   =0.000,5117.900        VSN=
TSKIP=15.100          DIGITS=0.000,976.500          TAPE22
S.R. =100.00 KHZ       10 04 PM,28 MAR 78.          FILE=42
                                                           1
```

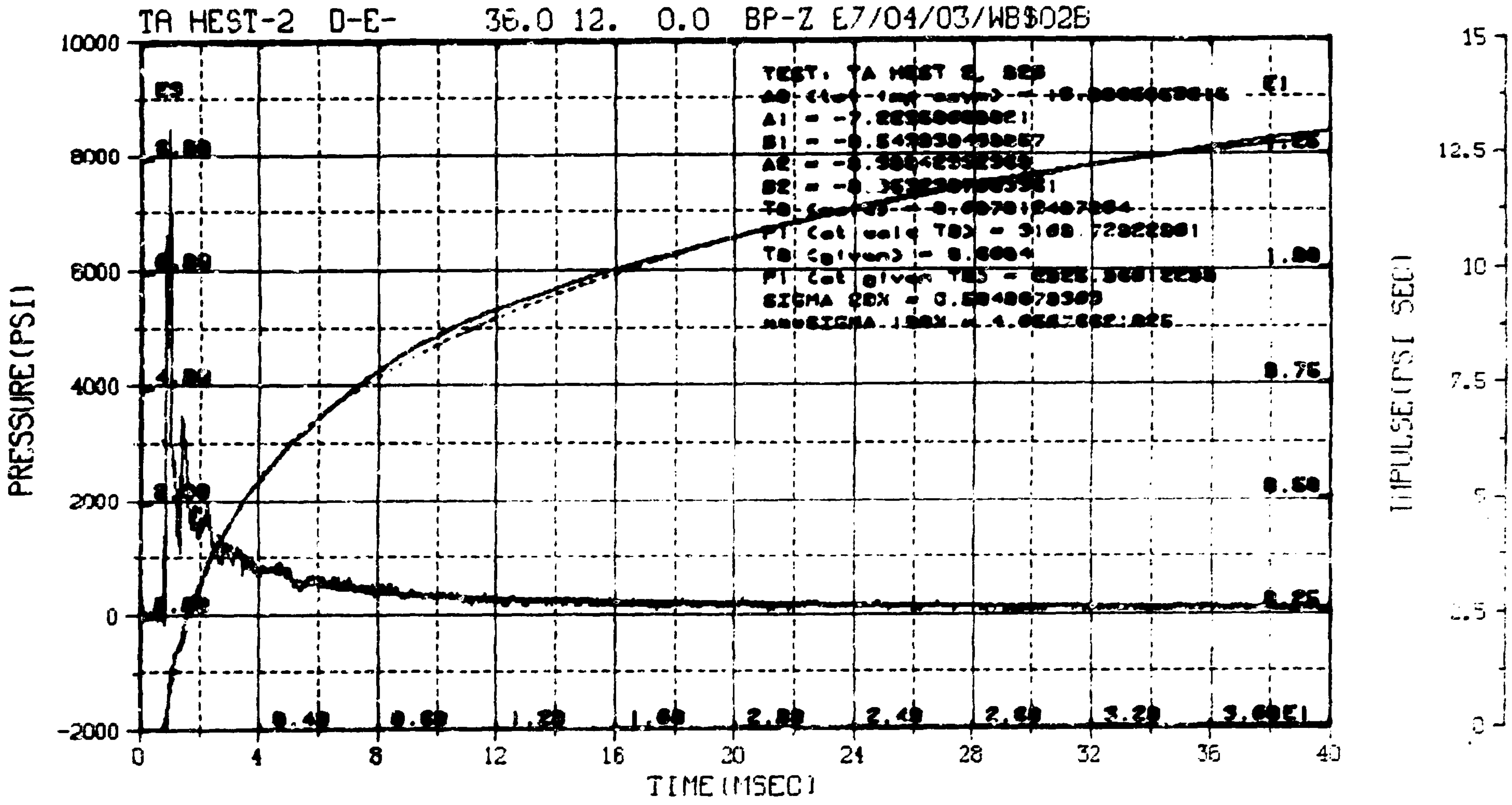

X VS. RESIDUALS FORTA WEST 2, 02
00 E1
E-1
2.00
1.00
0.00
-1.00
-2.00
0.00
0.50
1.00
1.50
2.


X VS. RESIDUALS FOR: TA HDST 2.62
E1
E-1
2.00
0.00
-2.00
-4.00
-6.00
0.00
1.00
2.00
3.00
4.



```
M.N. =     2           E.U.   =0.000,5117.900      VSN=
TSKIP=15.110           DIGITS=0.000,377.000        TAPE22
S.R. =100.00 KHZ         9.00 AM,29 MAR 78.        FILC=58
                                                          1
```


X VS. RESIDUALS FORTA WEST 2, 02B
00 E1
E-1
2.00
1.00
0.00
-1.00
-2.00
0.00
0.50
1.00
1.50
2.

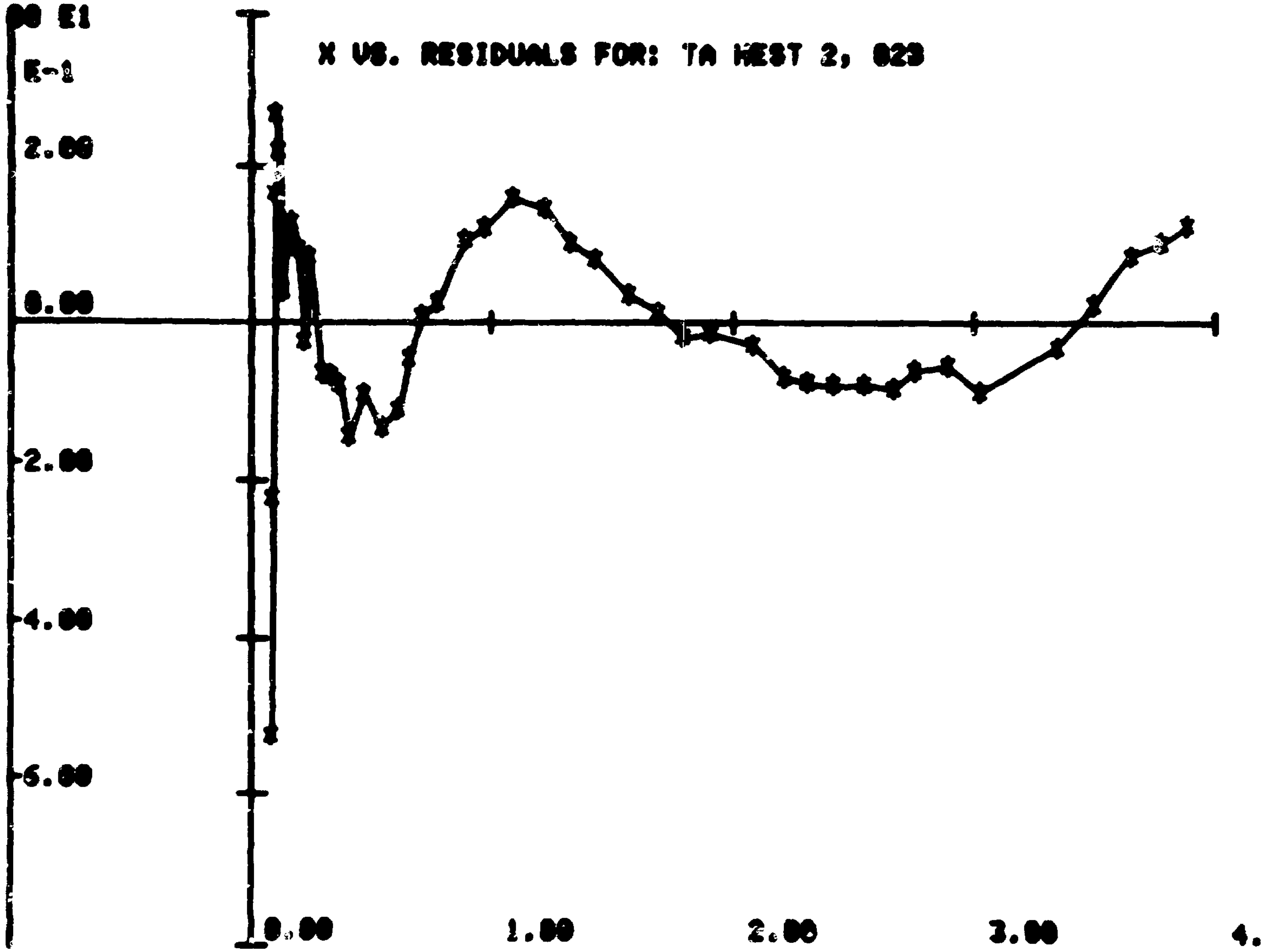


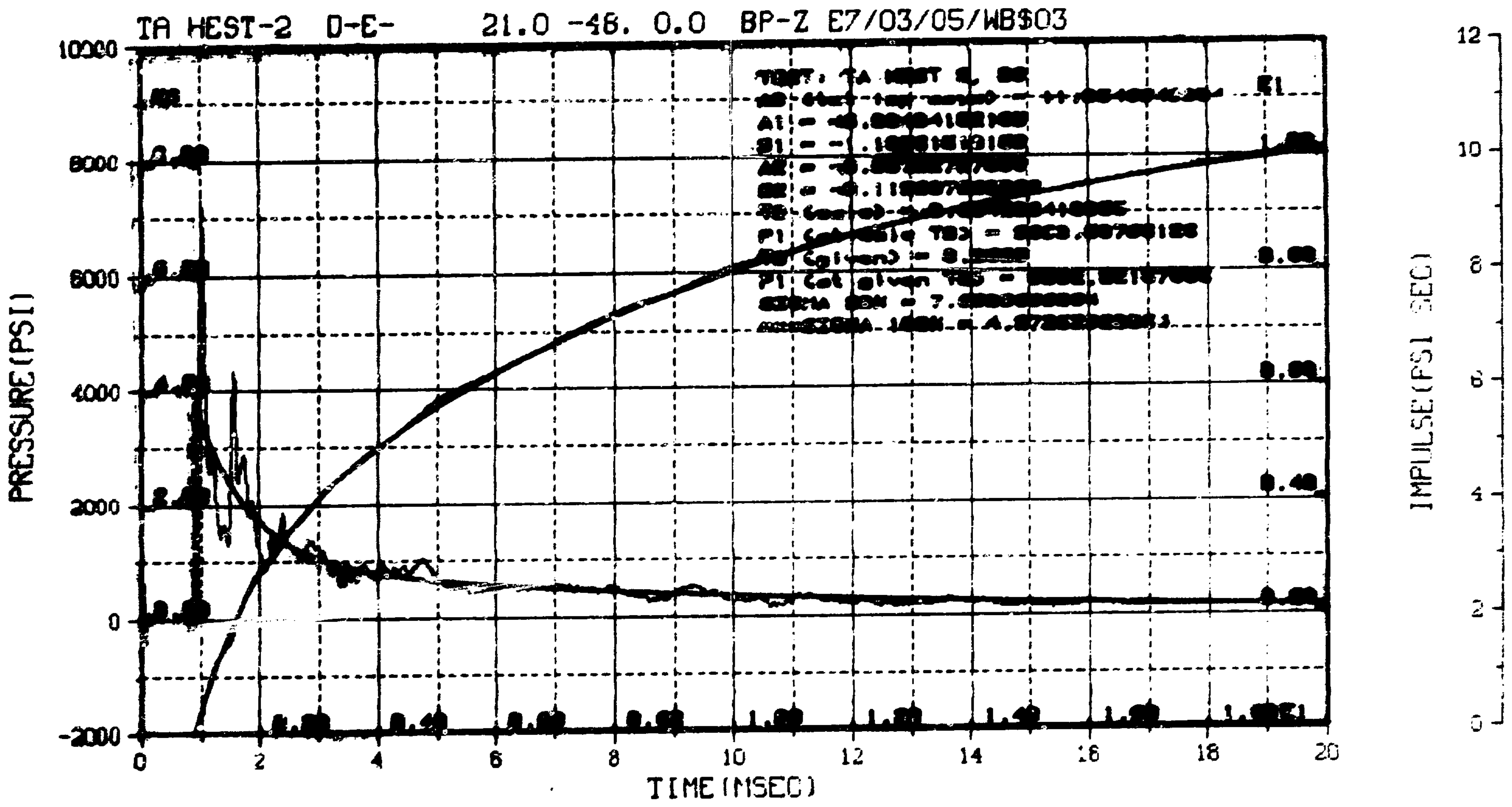
M.N. = 2
TSKIP=15.110
S.R. =100.00 KHZ

E.U. =0.000,5117.900
DIGITS=0.000,377.000
10 04 PM,28 MAR 73.

VSN=
TAPE22
FILE=58

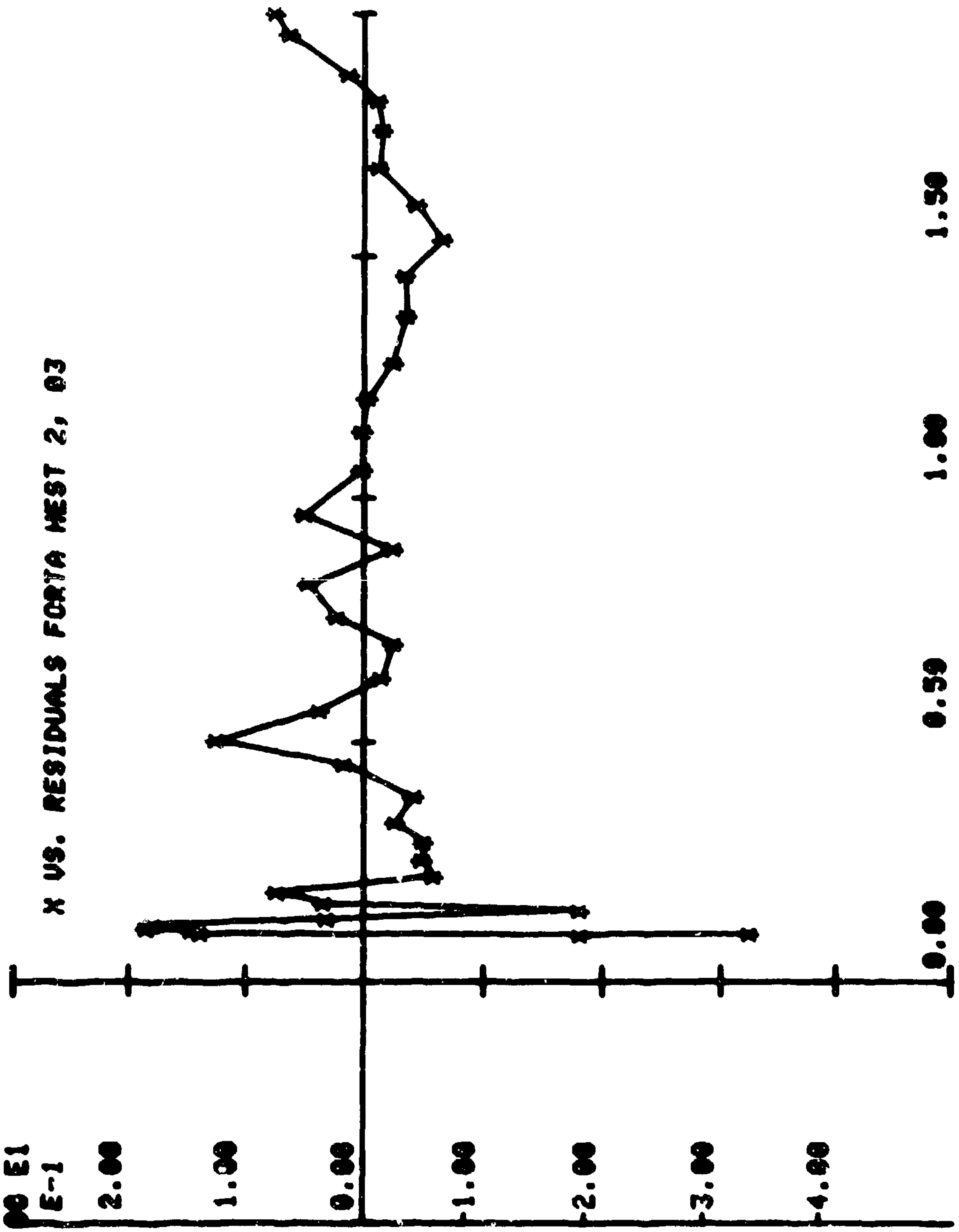
1


X VS. RESIDUALS FOR: TA WEST 2, 023
00 E1
E-1
2.00
0.00
-2.00
-4.00
-6.00
0.00
1.00
2.00
3.00
4.

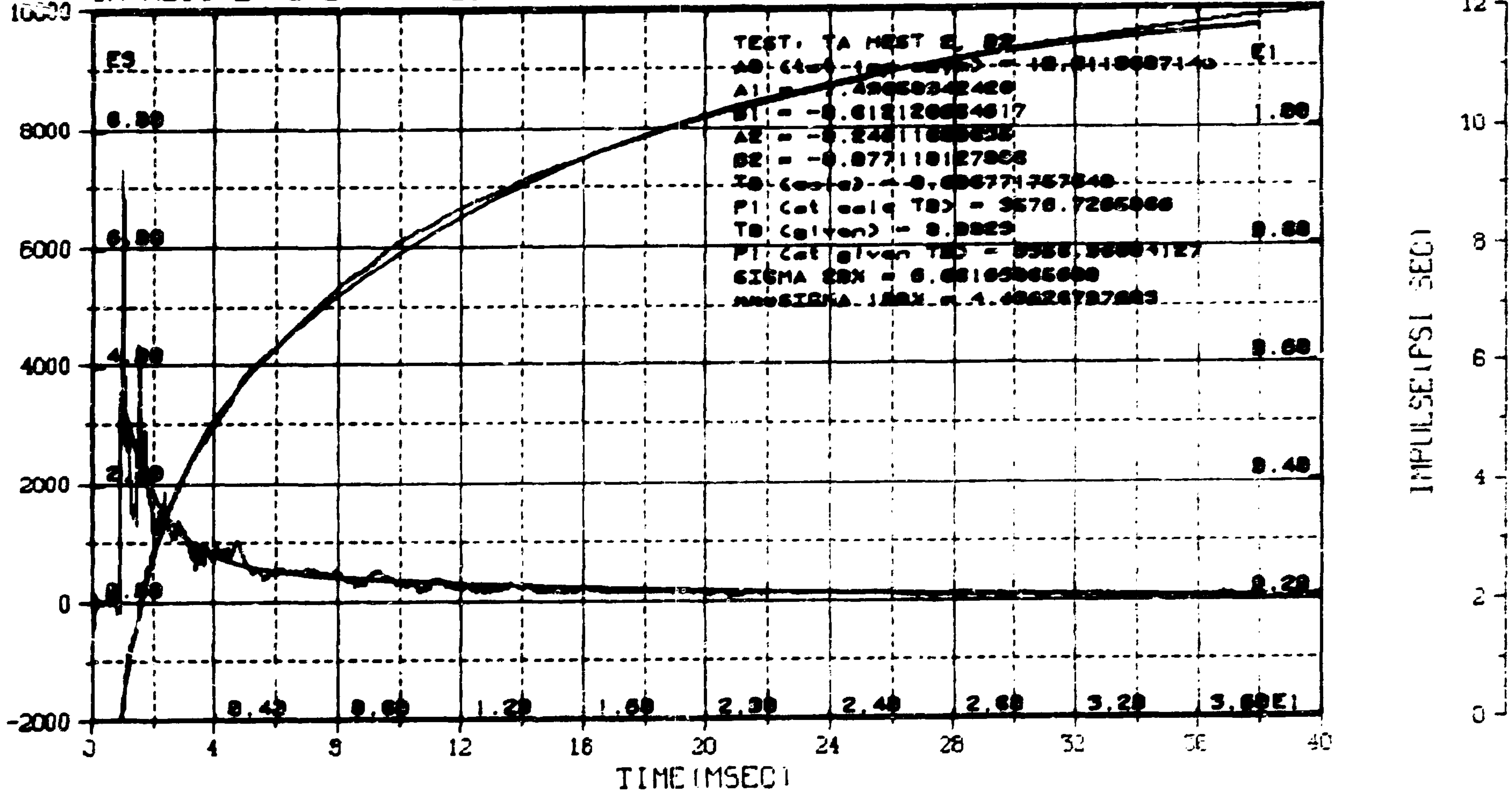


M.N. = 3 E.U. =0.000,5352.100 VSN=
TSKIP=15.100 DIGITS=0.000,729.500 TAPE22
S.R. =100.00 KHZ 10 04 PM,28 MAR 78. FILE=44

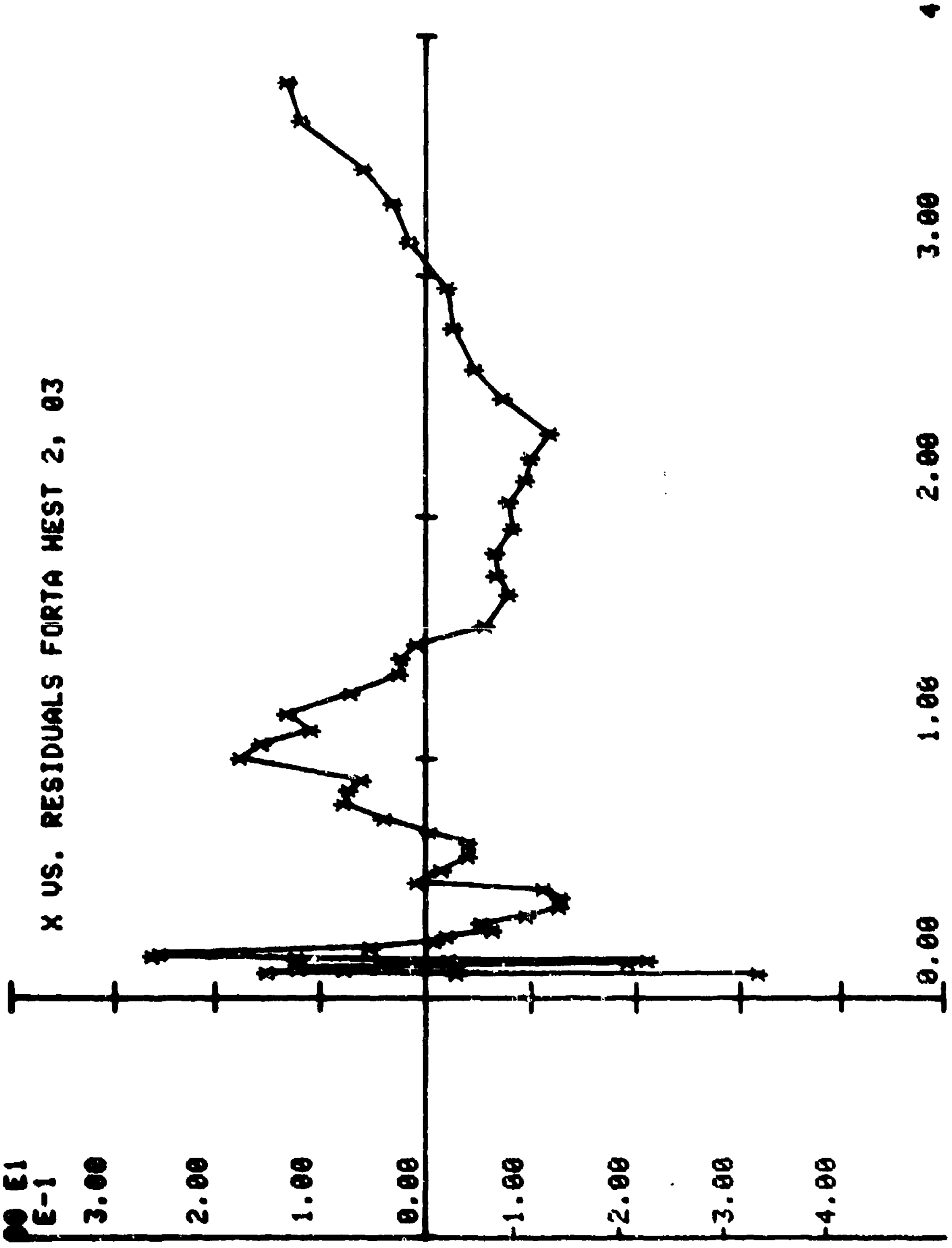
1


X VS. RESIDUALS FORTA WEST 2, 03
00 E1
E-1
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
0.00
0.50
1.00
1.50
2.

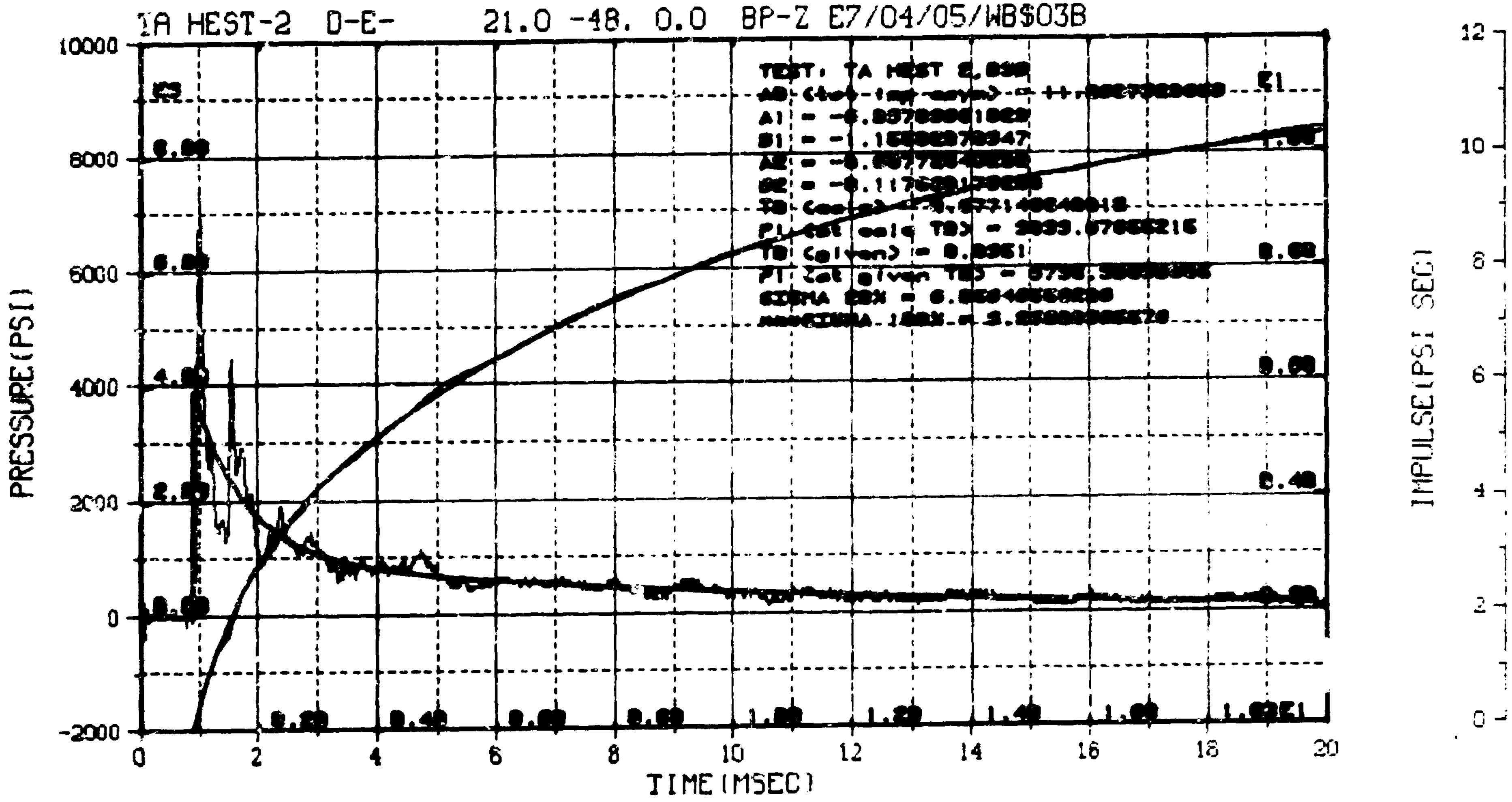
TA HEST-2 0-E- 21.0 -48. 0.0 BP-Z E7/03/05/WB$03



M.N. = 3 E.U. =0.000,5352.100 VSN=
TSKIP=15.100 DIGITS=0.000,729.500 TAPE22
S.R. =100.00 KHZ 10 04 PM,28 MAR 78. FILE=44



X VS. RESIDUALS FORTA WEST 2, 03

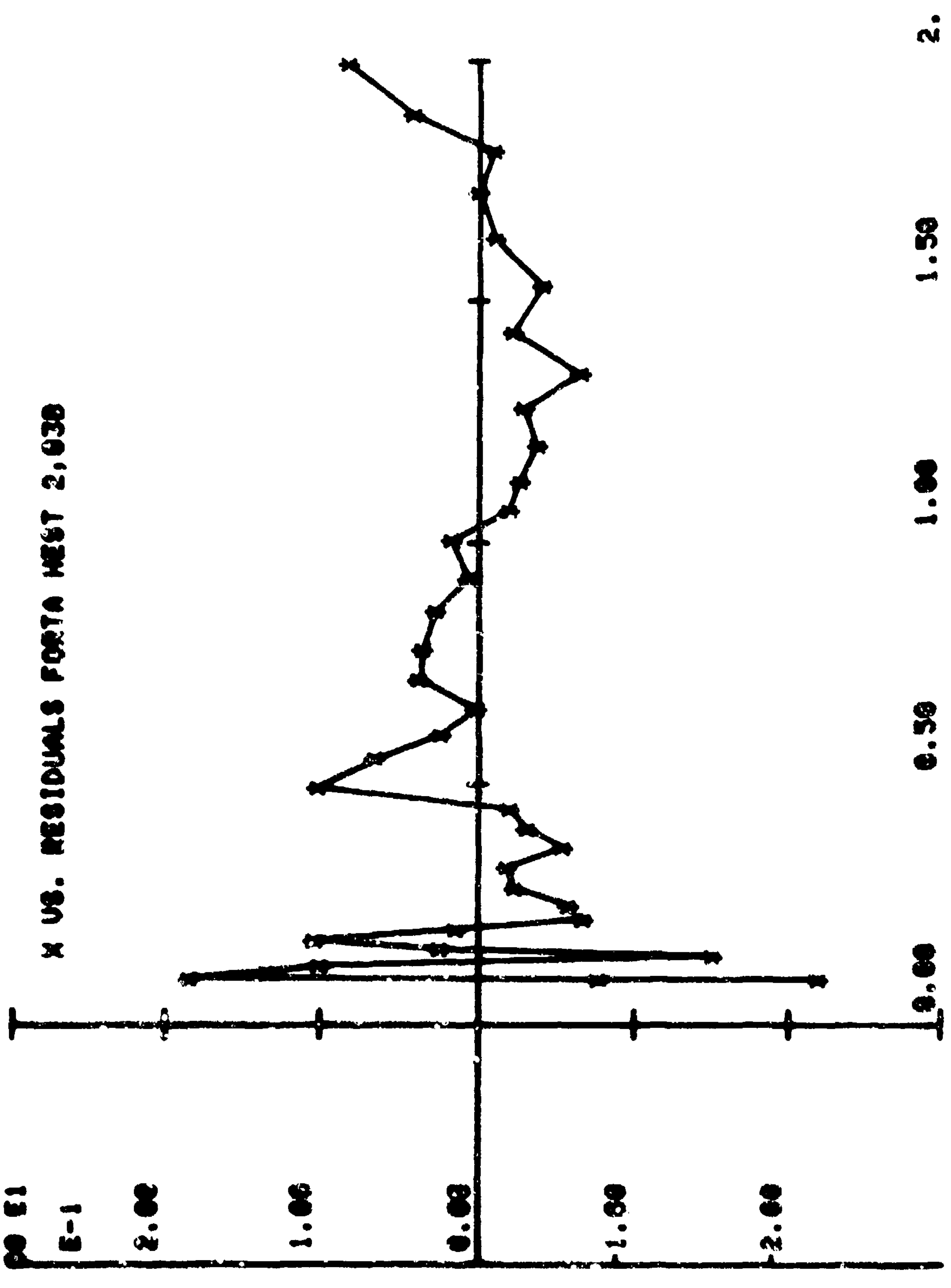


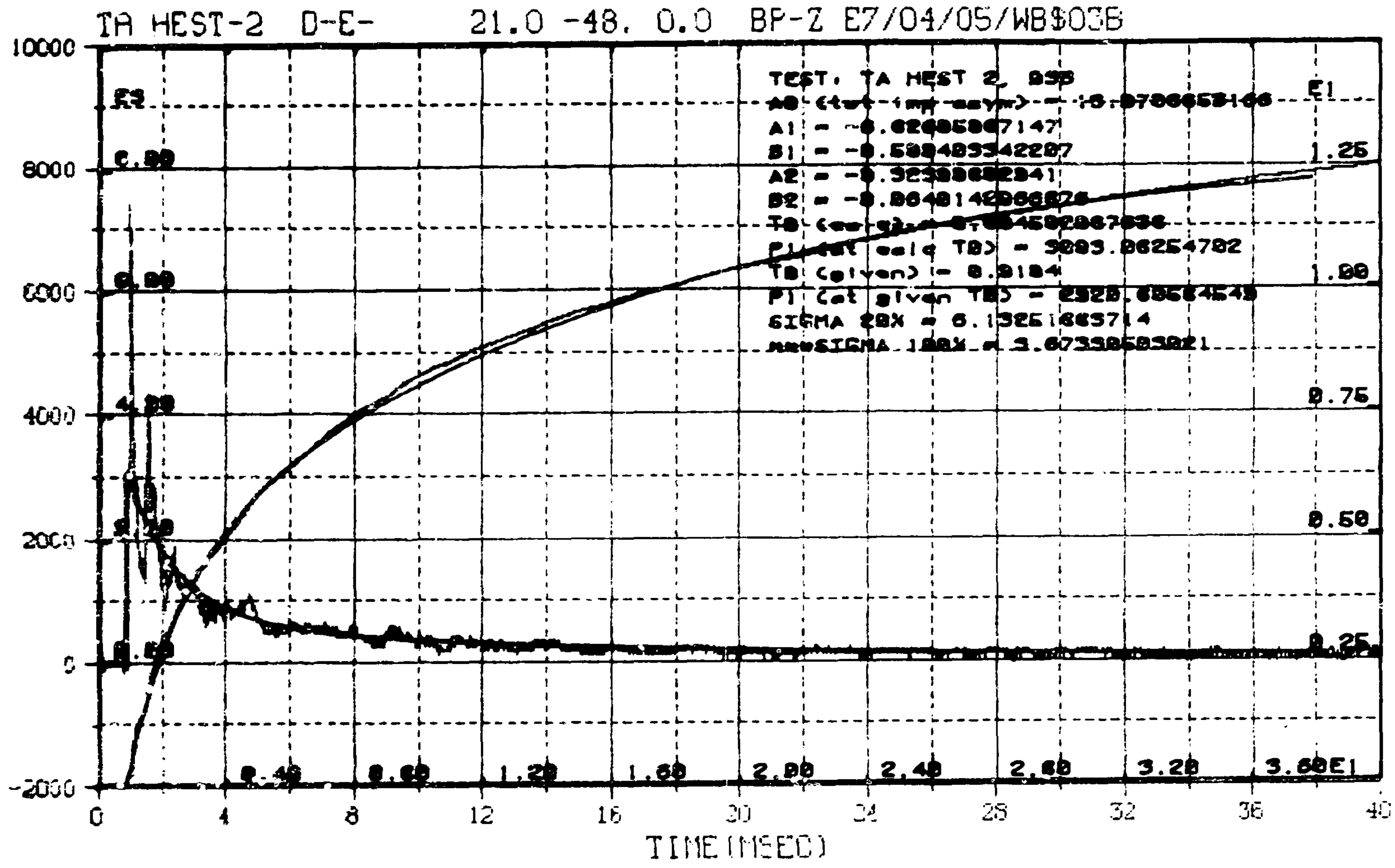
M.N. = 3
TSKIP=15.110
S.R. =100.00 KHZ

E.U. =0.000,5352.100
DIGITS=0.000,290.500
9 00 AM, 29 MAR 78.

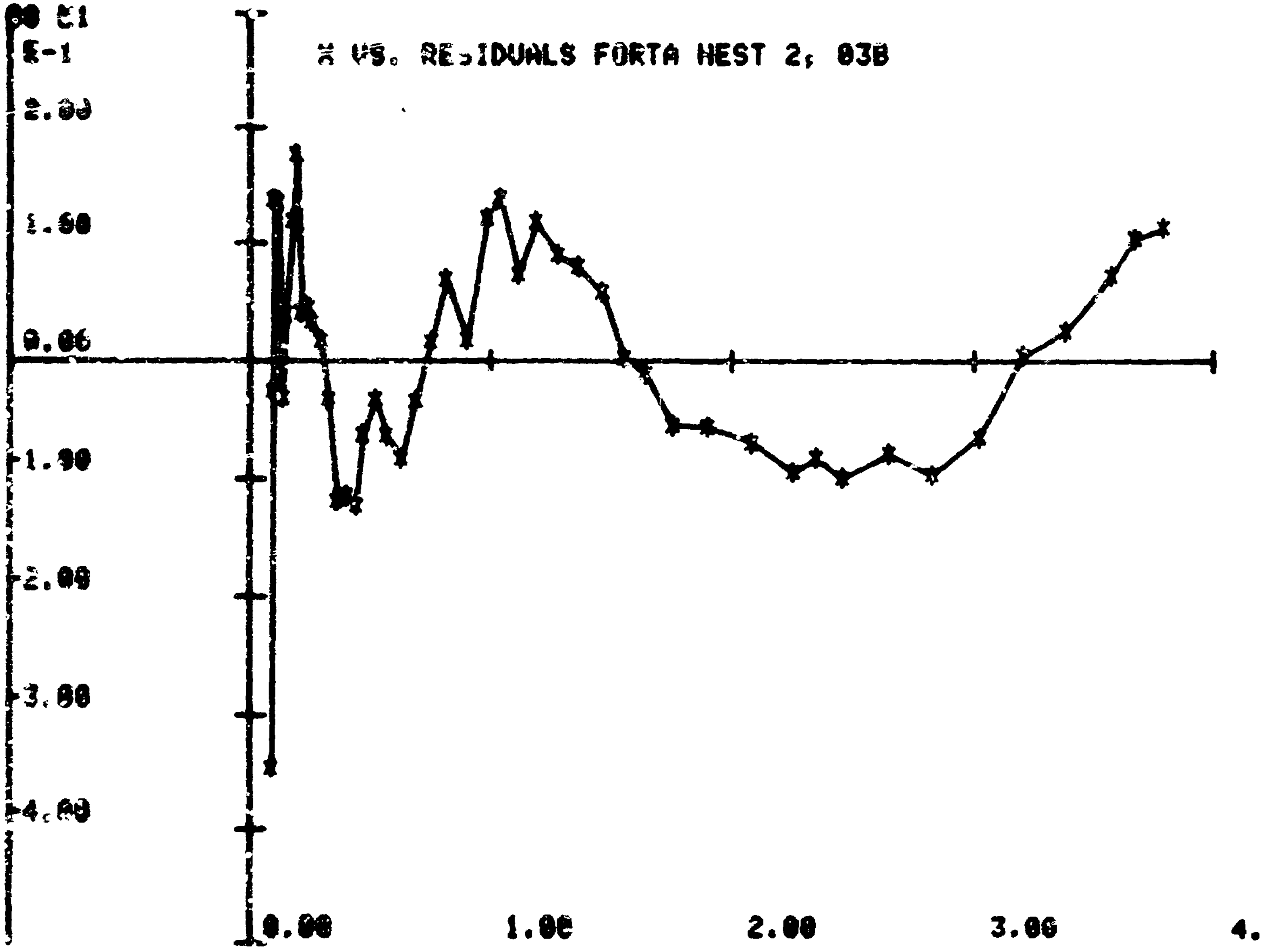
VSN=
TAPE22
FILE=60

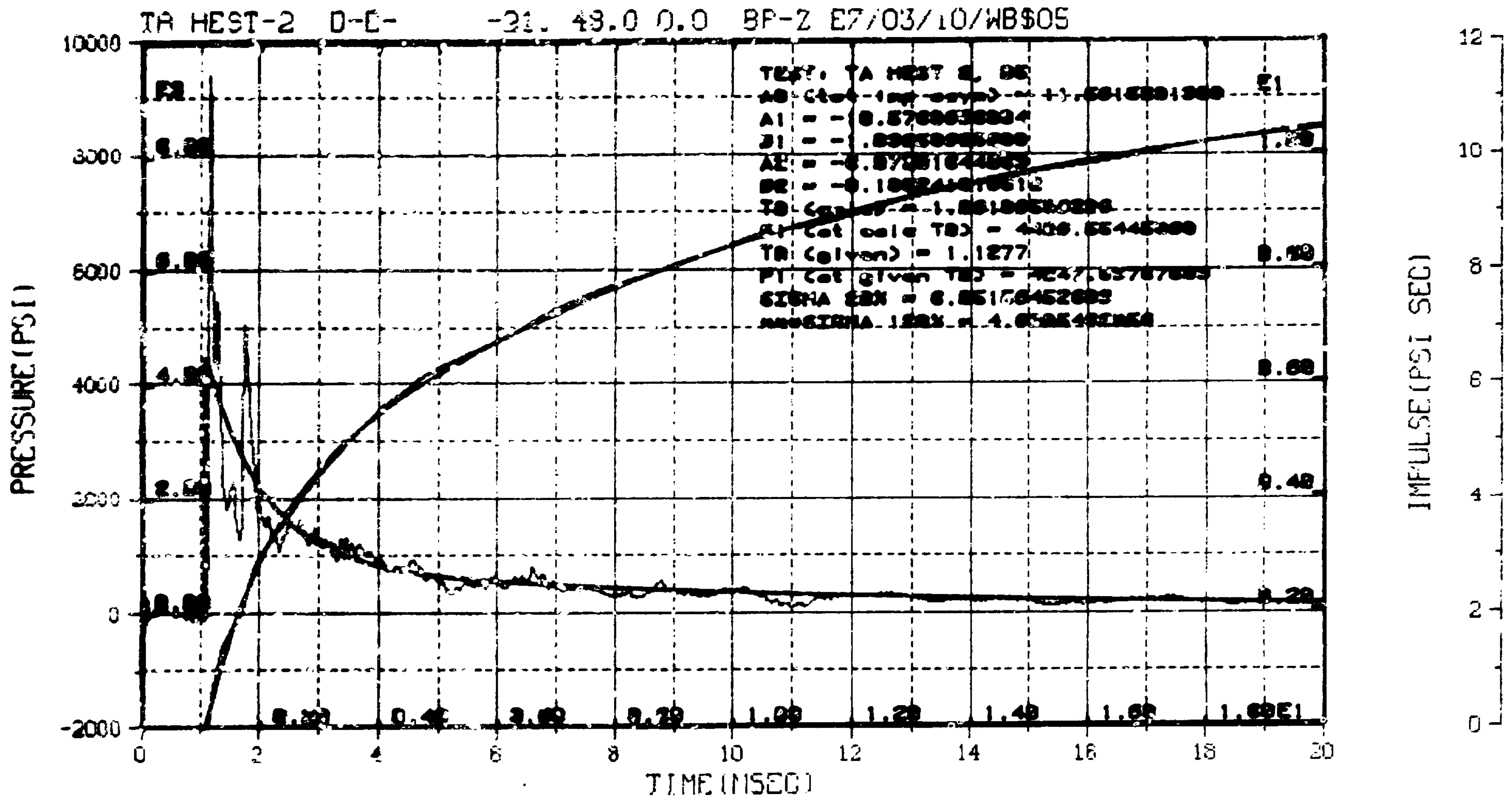
1


X VS. RESIDUALS FORTA WEST 2,030
0 E1
E-1
2.00
1.00
0.00
-1.00
-2.00
0.00
0.50
1.00
1.50
2.

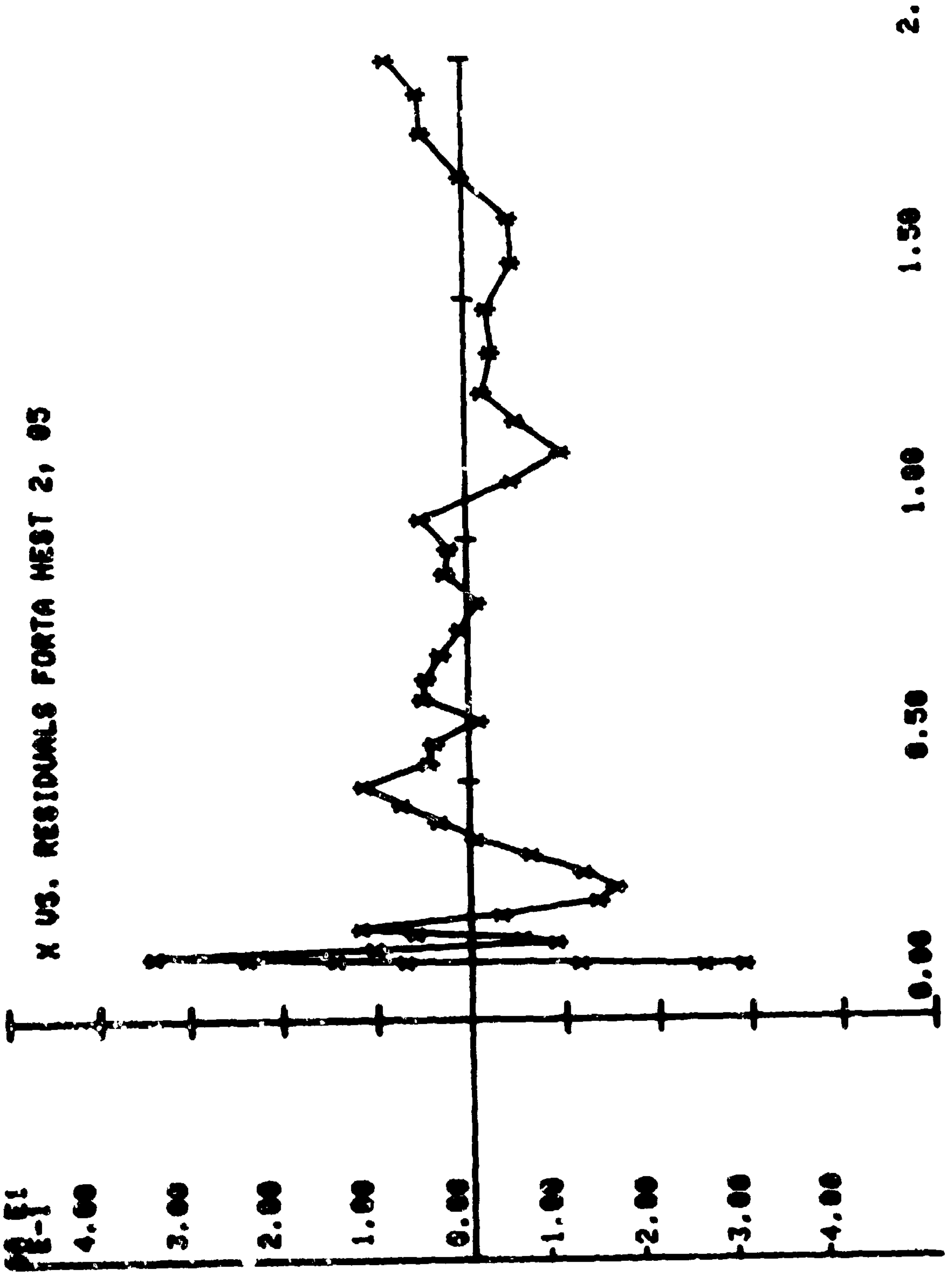


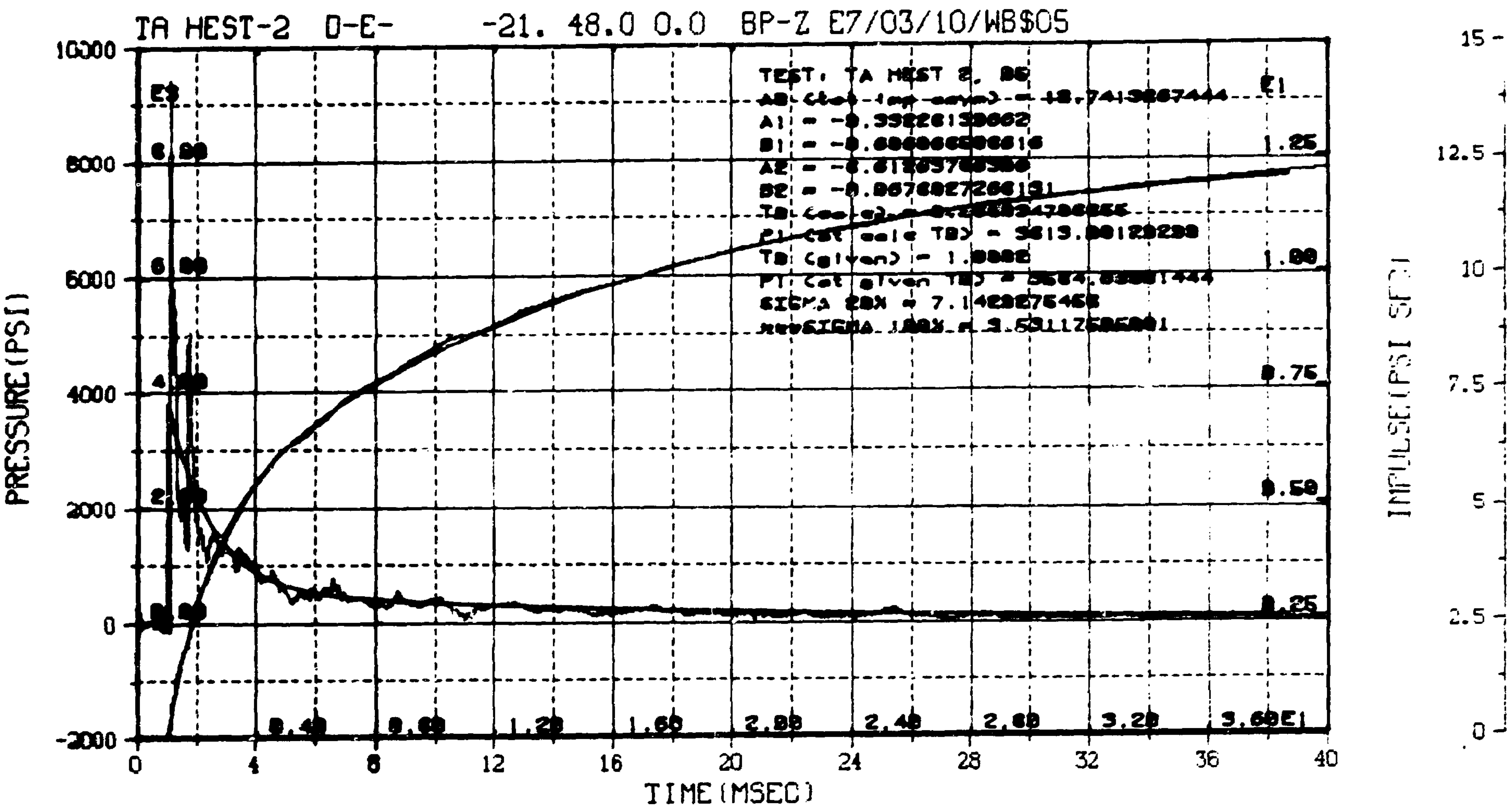
```
M.N. =      3         E.U.   =0.000,5352.100      VSN=
TSKIP=15.110          DIGITS=0.000,290.500        TAPE22
S.R. =100.00 KHZ       10 04 PM,28 MAR 78.        FILE=60
                                                          1
```


X VS. RESIDUALS FORTA HEST 2, 03B
00 E1
E-1
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
0.00
1.00
2.00
3.00
4.



M.N. = 5 E.U. =0.000,5371.600 VSN=
TSKIP=15.100 DIGITS=0.000,722.500 TAPE22
S.R. =100.00 KHZ 10 04 PM,28 MAR 78. FILE=48
1


X VS. RESIDUALS FORTA WEST 2, 05
E-1
4.00
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
0.00
0.50
1.00
1.50
2.

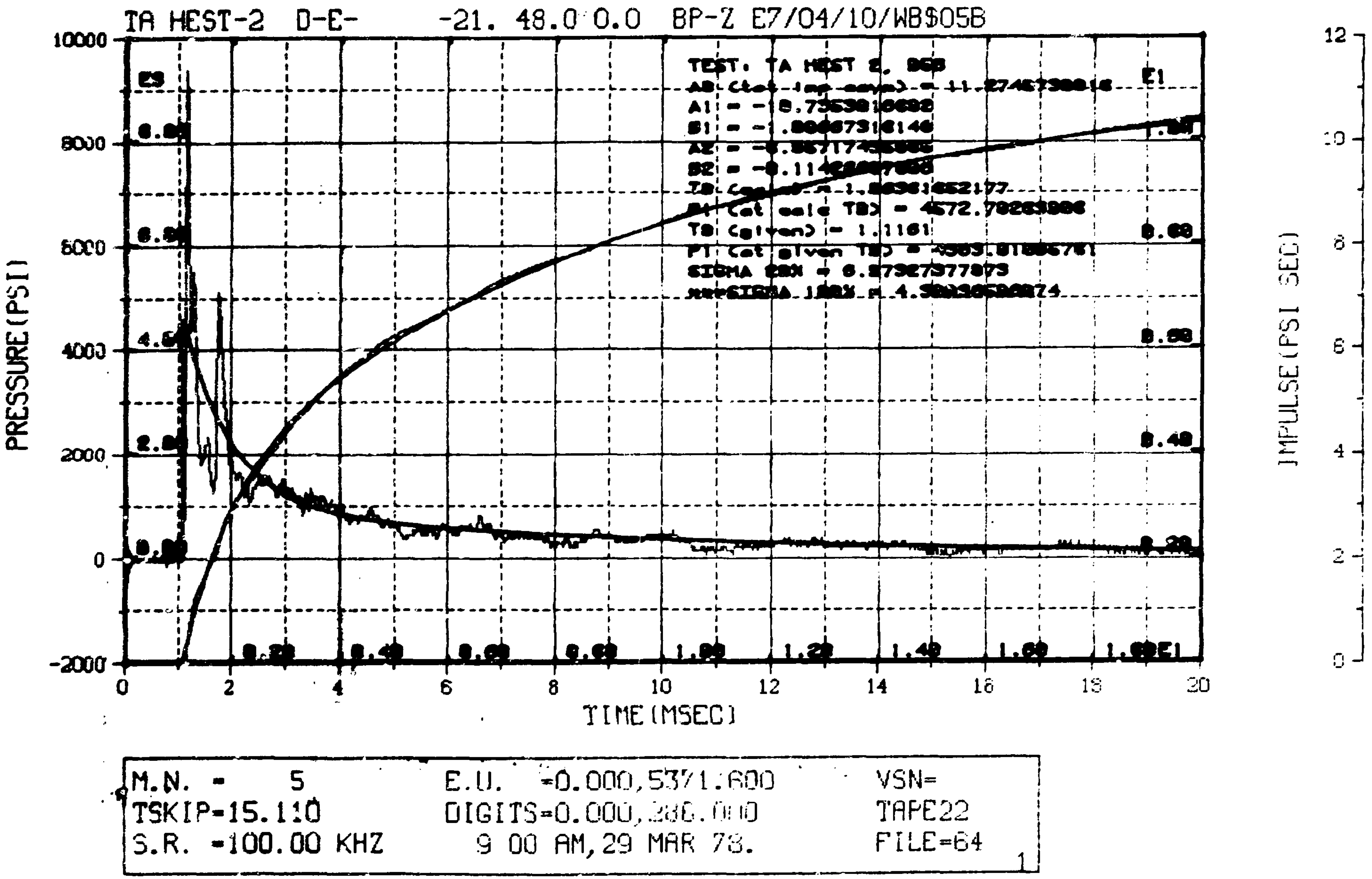


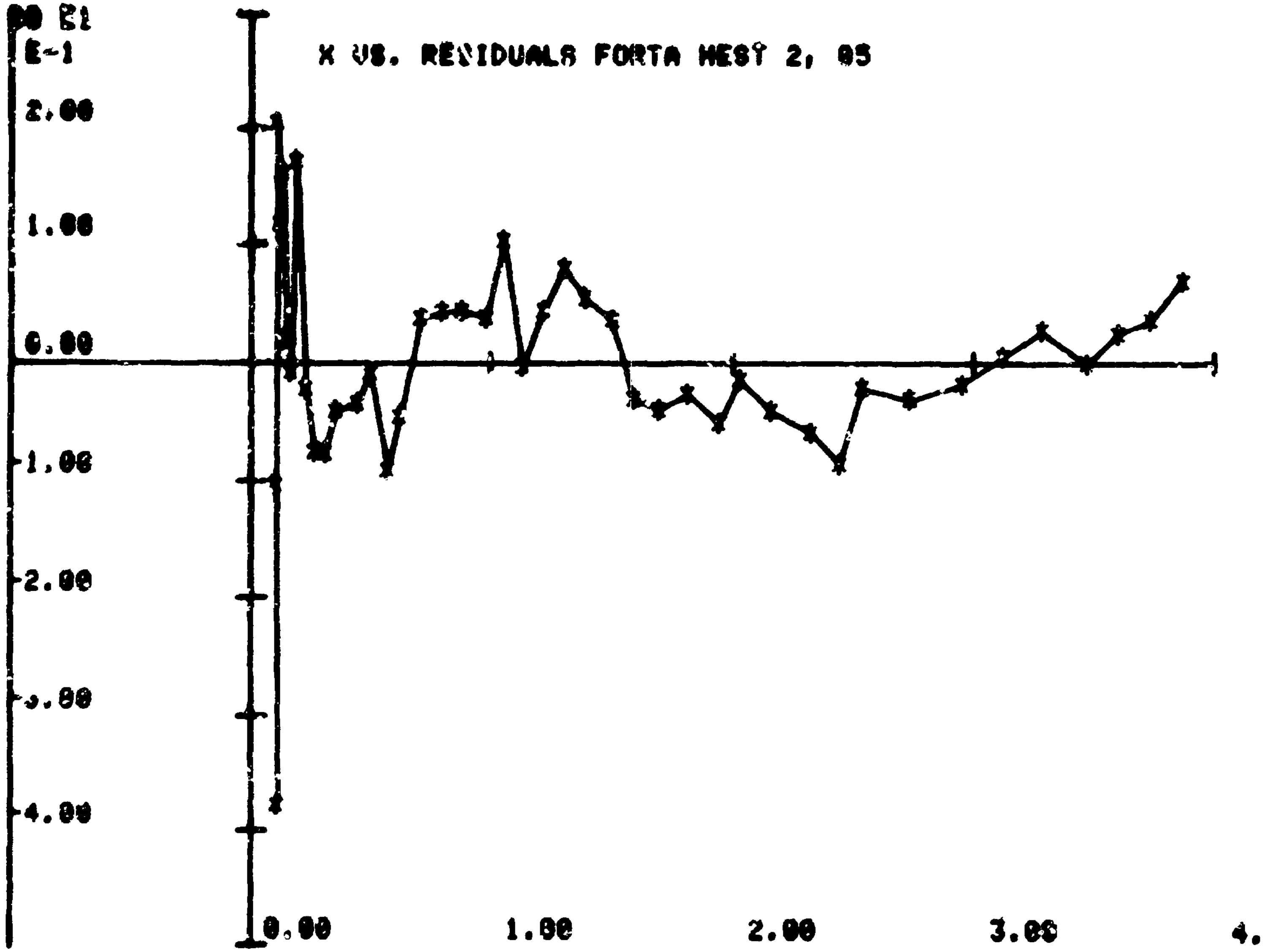
M.N. = 5
TSKIP=15.100
S.R. =100.00 KHZ

E.U. =0.000,5371.600
DIGITS=0.000,722.500
10 04 PM,28 MAR 78.

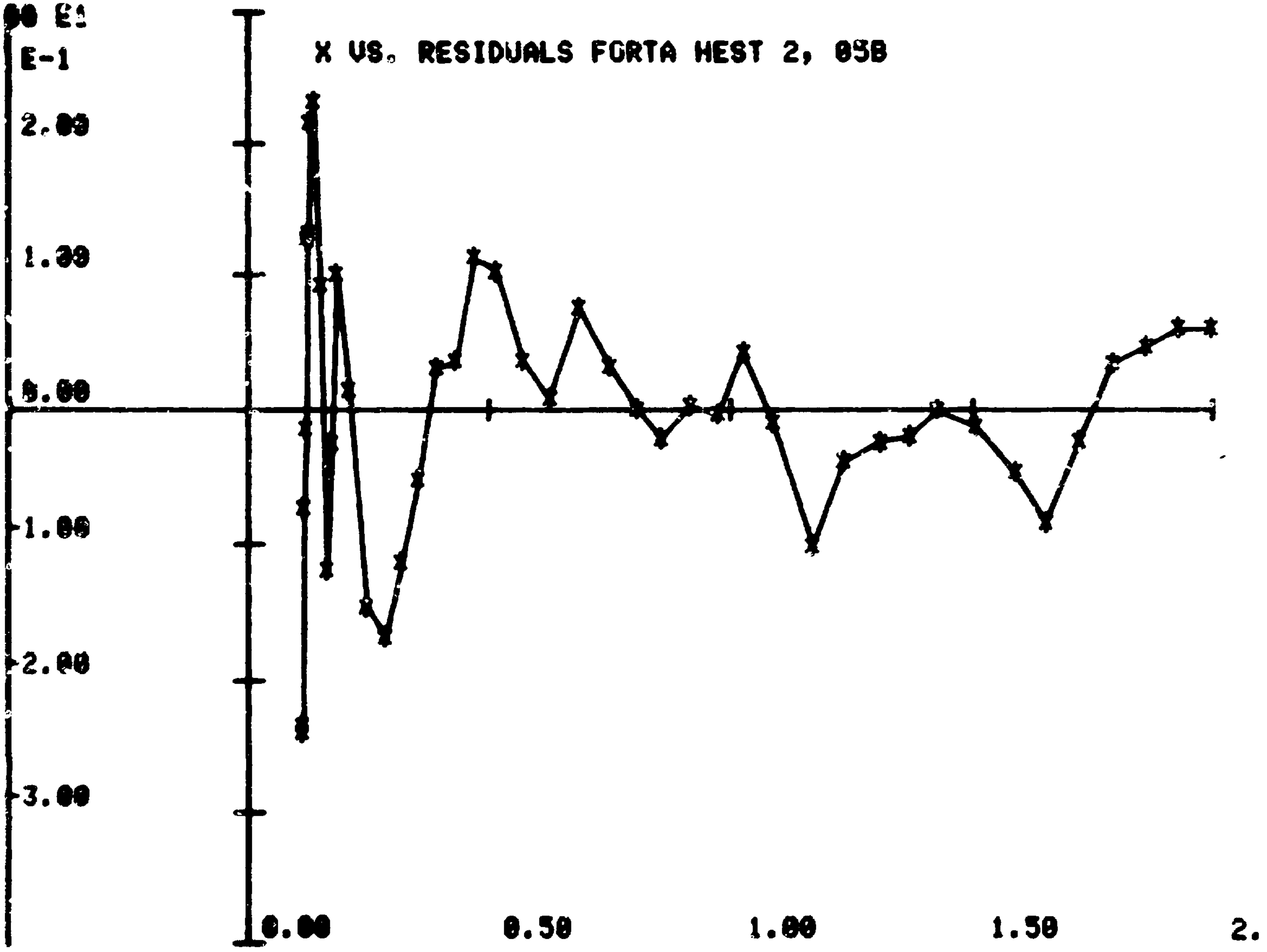
VSN=
TAPE22
FILE=48

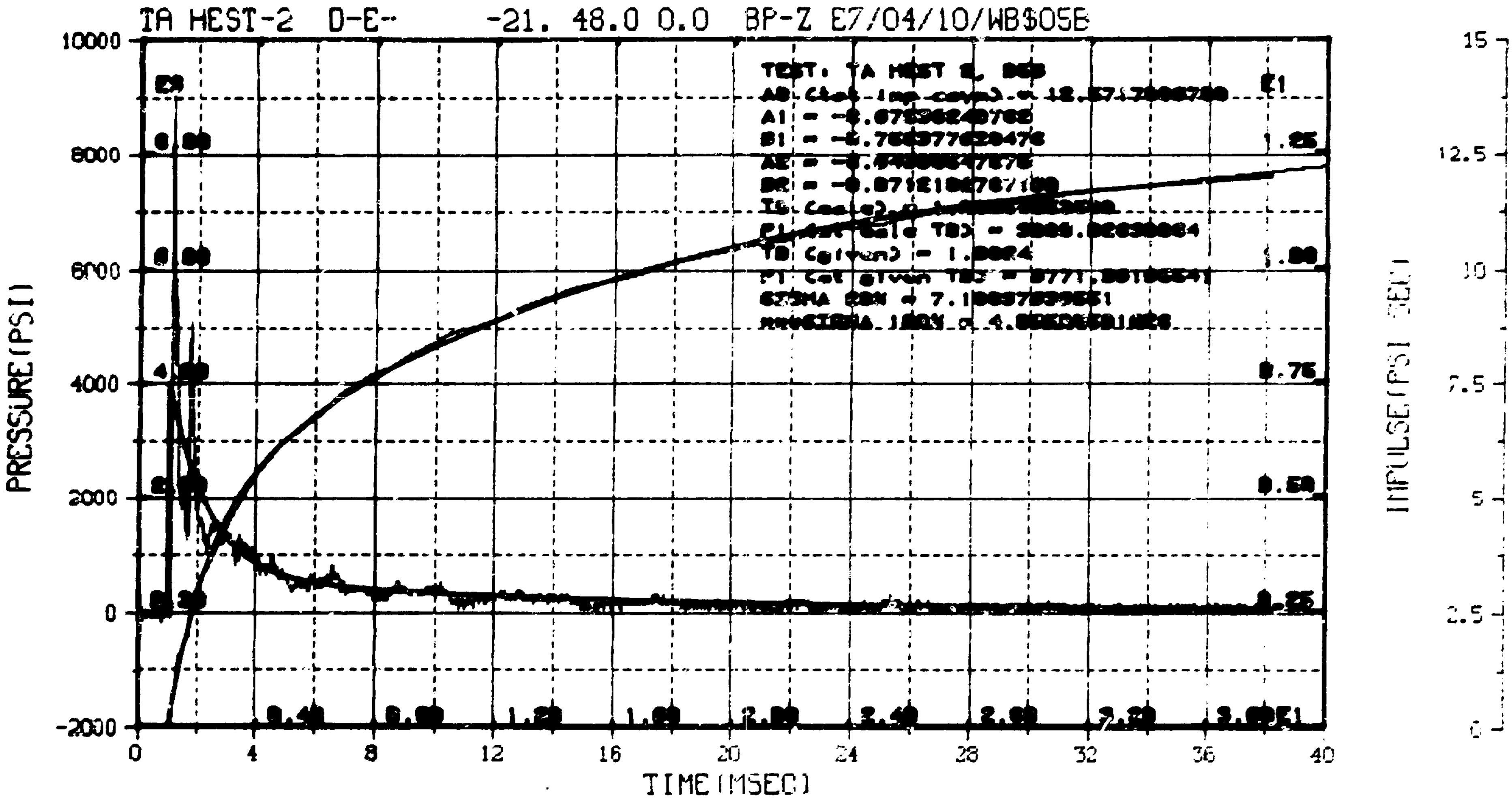
1


TA HEST-2 D-E- -21. 48.0 0.0 BP-Z E7/04/10/WB$05B
TEST: TA HEST 2, 36B
AB (tot imp corr) = 11.2745739
A1 = -8.7353810
B1 = -1.80667316146
A2 = -8.85717
B2 = -8.114
TB (calc) = 1.8636165217
P1 (at calc TB) = 4572.7826
TB (given) = 1.1161
P1 (at given TB) = 4583.8188
SIGMA 28% = 6.273273777
***SIGMA 100% = 4.3
E3
E1
8.00
6.00
4.00
2.00
0.00
1.00
0.80
0.60
0.40
0.20
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80E1
PRESSURE(PSI)
10000
8000
6000
4000
2000
0
-2000
IMPULSE(PSI SEC)
12
10
8
6
4
2
0
TIME(MSEC)
0
2
4
6
8
10
12
14
16
18
20
M.N. = 5
TSKIP=15.110
S.R. =100.00 KHZ
E.U. =0.000,53%1.600
DIGITS=0.000,286.000
9 00 AM,29 MAR 78.
VSN=
TAPE22
FILE=64
1



X VS. RESIDUALS FORTA WEST 2, 05


X VS. RESIDUALS FORTA WEST 2, 05B
00 E1
E-1
2.00
1.00
0.00
-1.00
-2.00
-3.00
0.00
0.50
1.00
1.50
2.

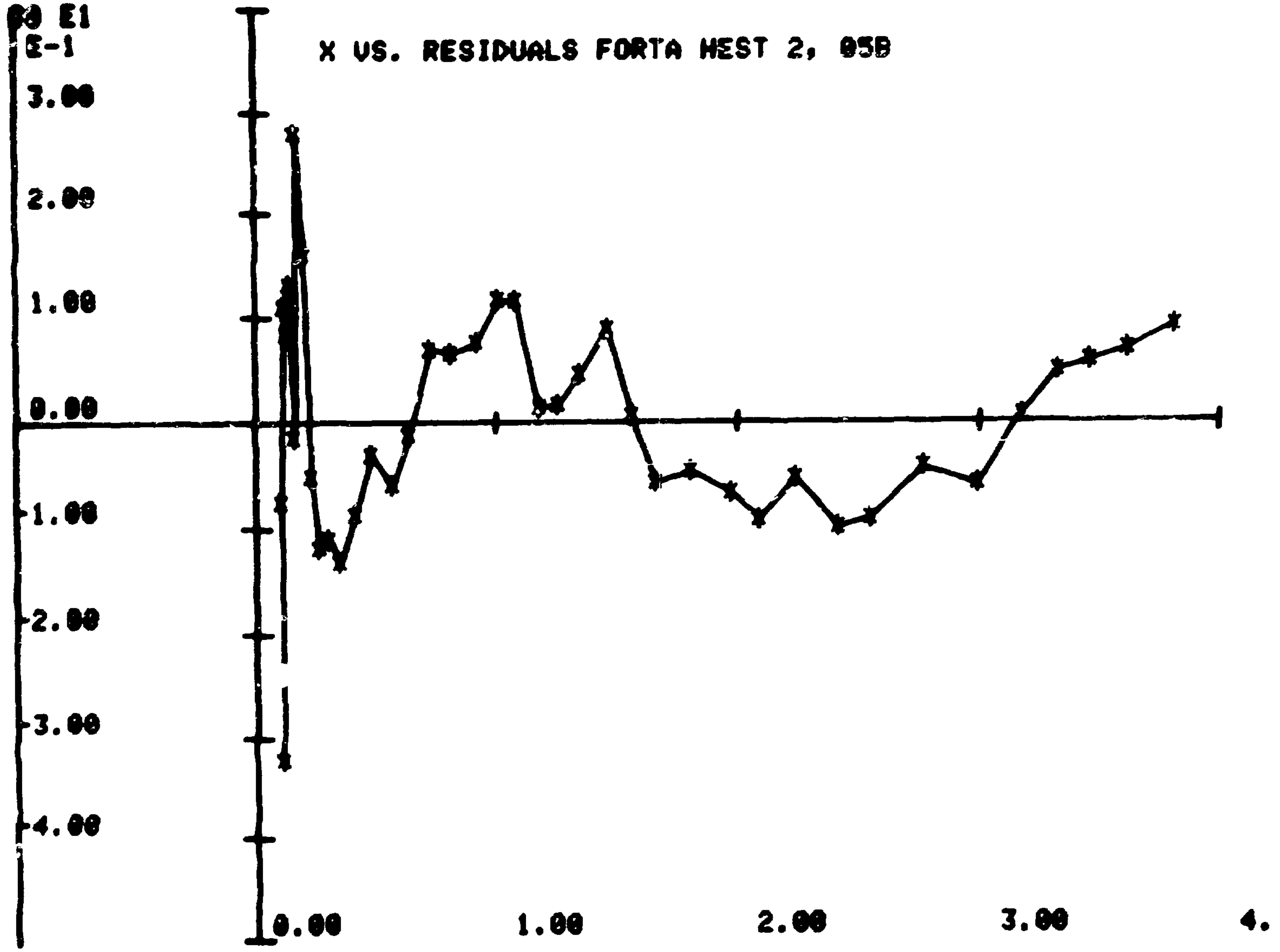


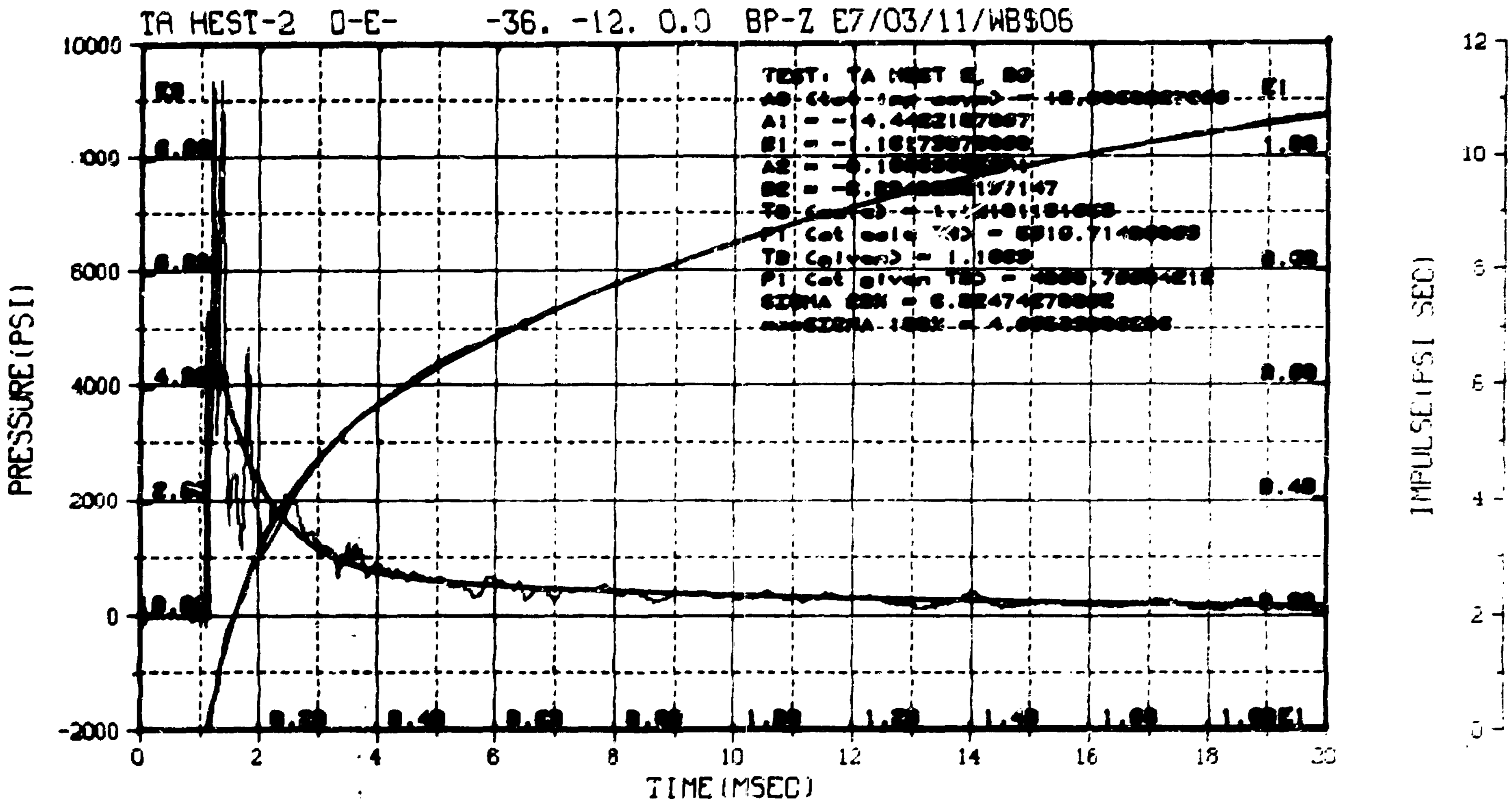
M.N. = 5
TSKIP=15.110
S.R. =100.00 KHZ

E.U. =0.000,5371.600
DIGITS=0.000,256.000
10 04 PM, 28 MAR 78.

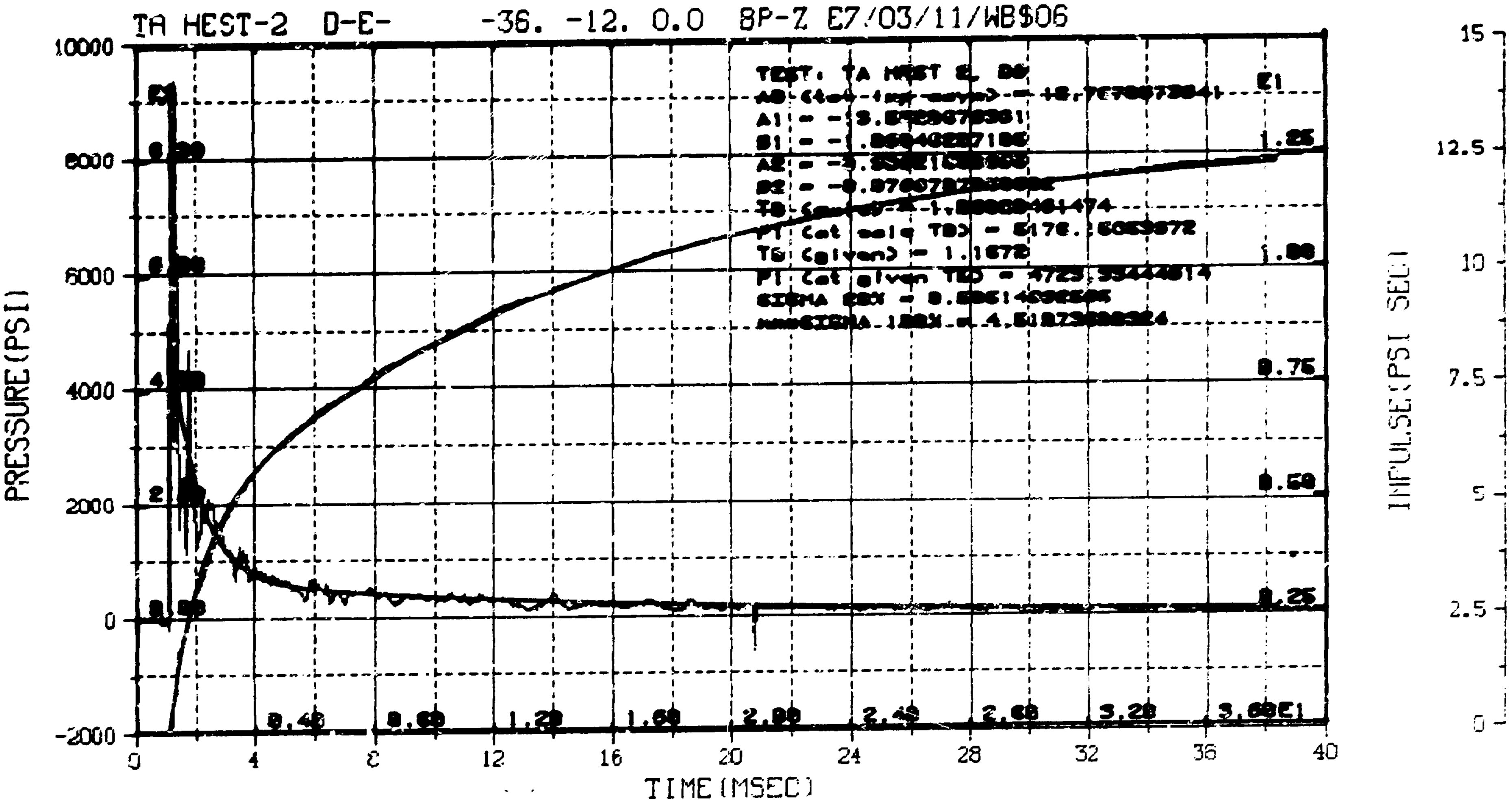
VSN=
TAPE22
FILE=64

1


X VS. RESIDUALS FORTA WEST 2, 05B
00 E1
E-1
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
0.00
1.00
2.00
3.00
4.

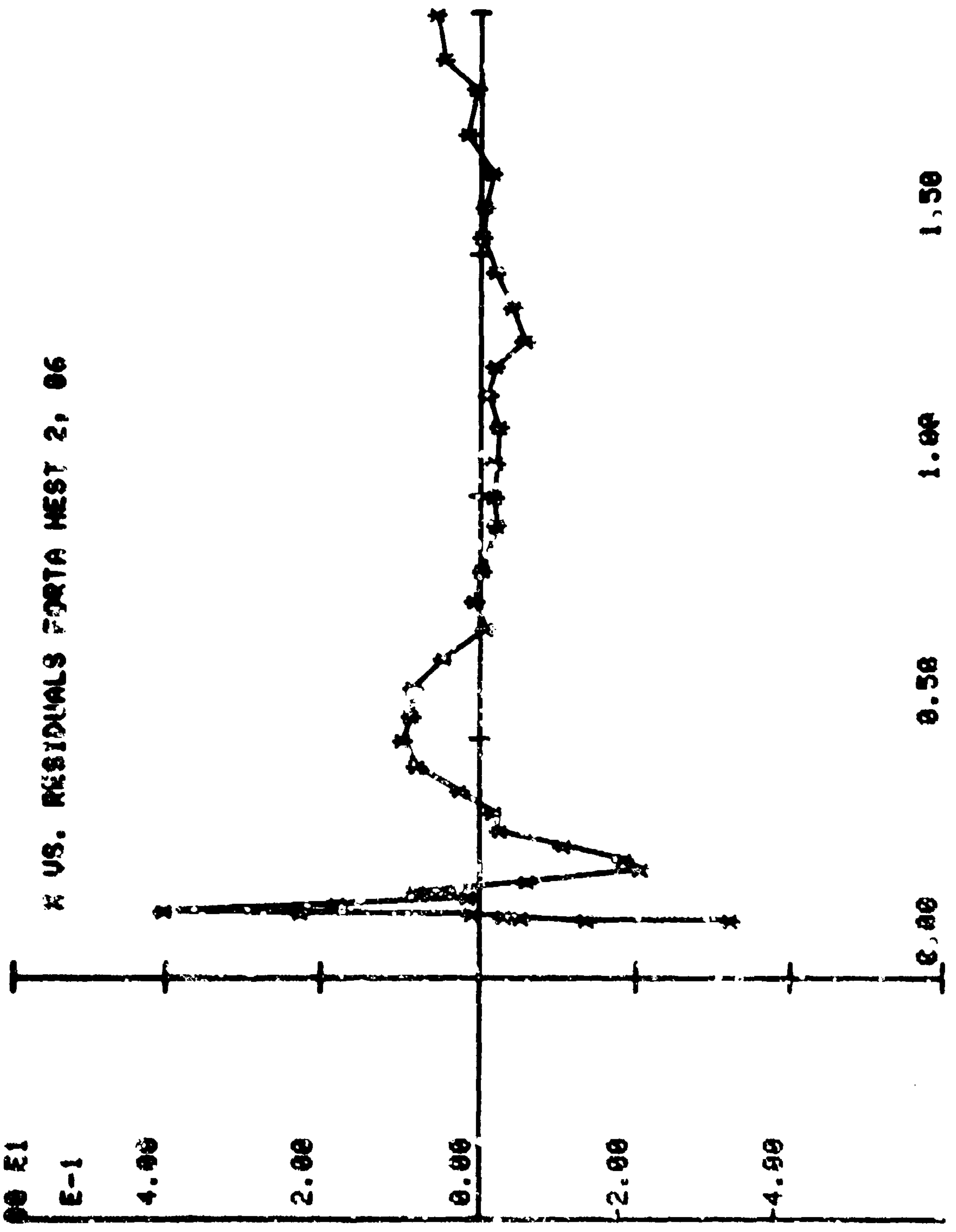


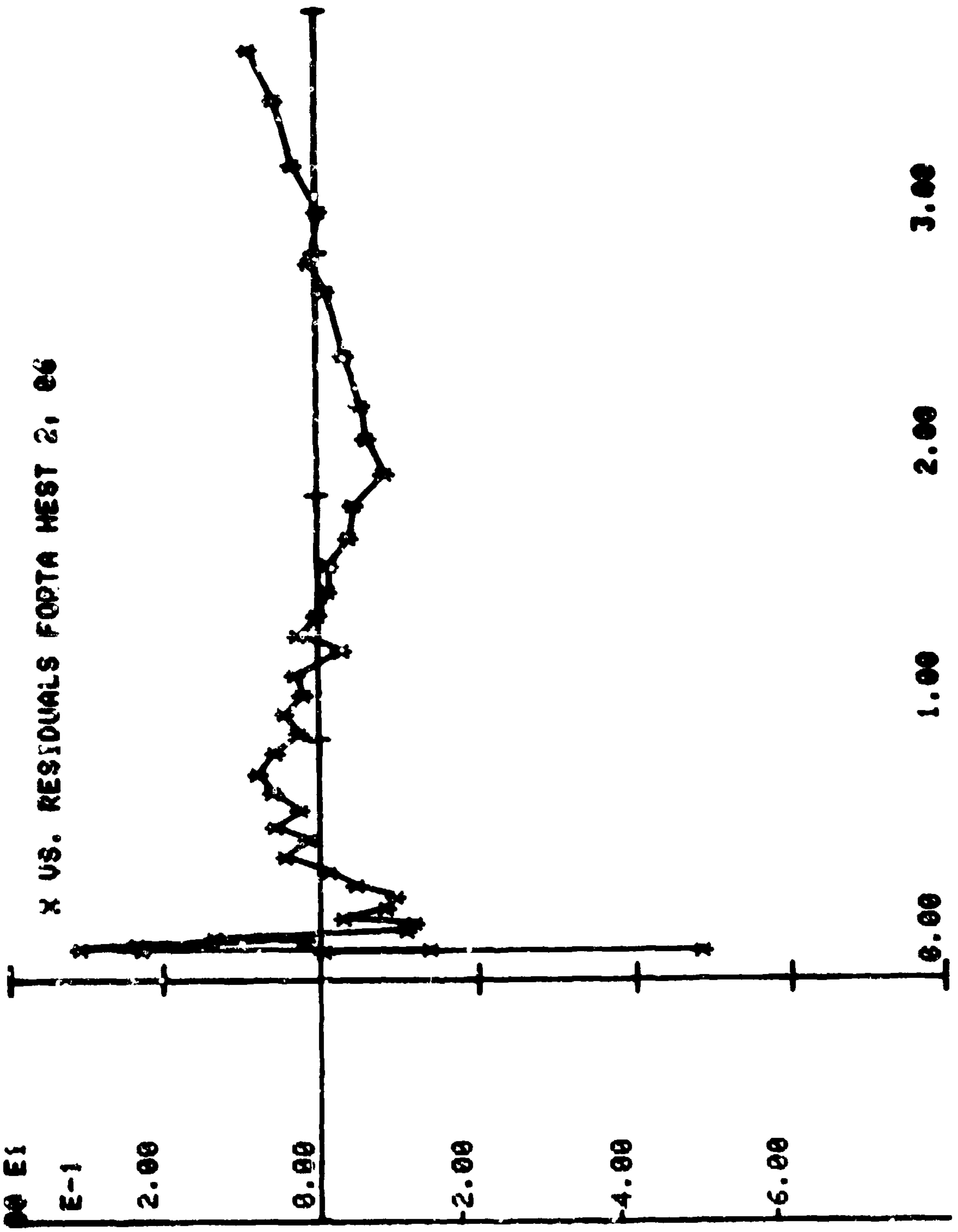
```
M.N. -     5          E.U.   -0.000,5416.600        VSN-
TSKIP-15.100          DIGITS-0.000,966:500          TAPE22
S.R. -100.00 KHZ       10 04 PM,28 MAR 78.          FILE-50
```

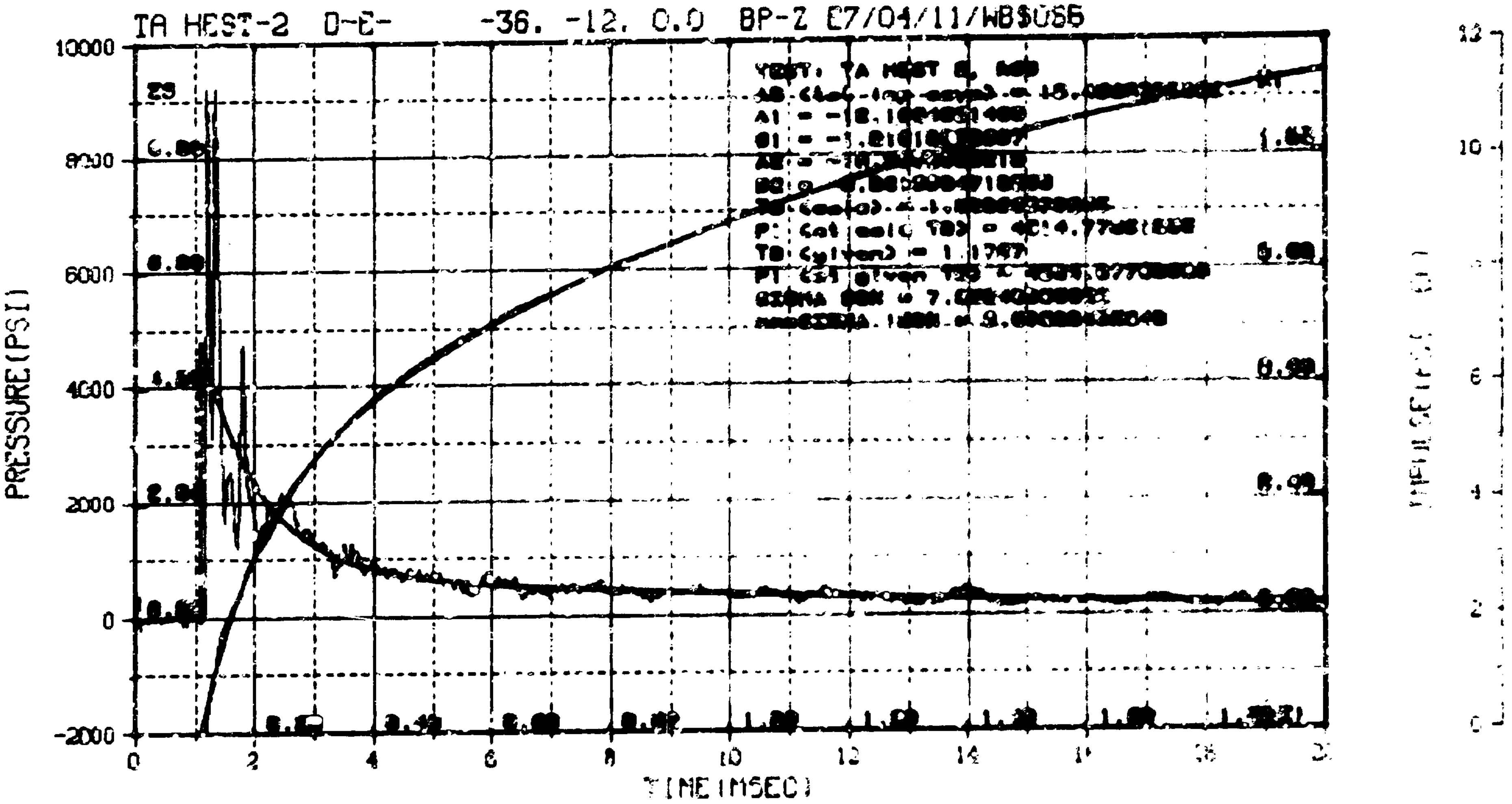


M.N. = 6	E.U. =0.000,5416.600	VSN=
TSKIP=15.100	DIGITS=0.000,966.500	TAPE22
S.R. =100.00 KHZ	10 04 PM,28 MAR 78.	FILE=50

1


X VS. RESIDUALS PORTA WEST 2, 06
00 E1
E-1
4.00
2.00
0.00
-2.00
-4.00
0.00
0.50
1.00
1.50
2.

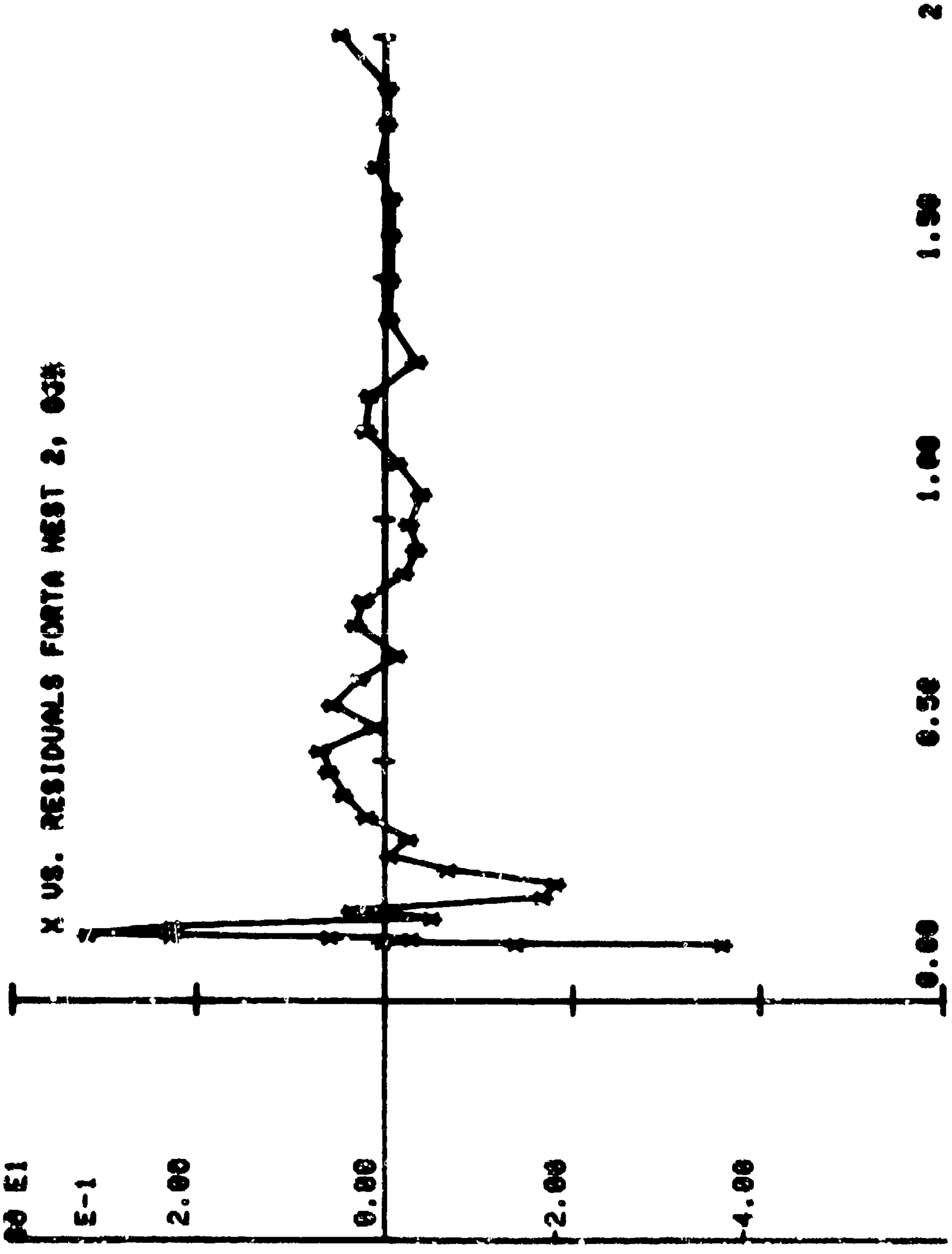

X VS. RESIDUALS FORTA WEST 2, 06
0.00
1.00
2.00
3.00
4.
E1
E-1
2.00
0.00
-2.00
-4.00
-6.00



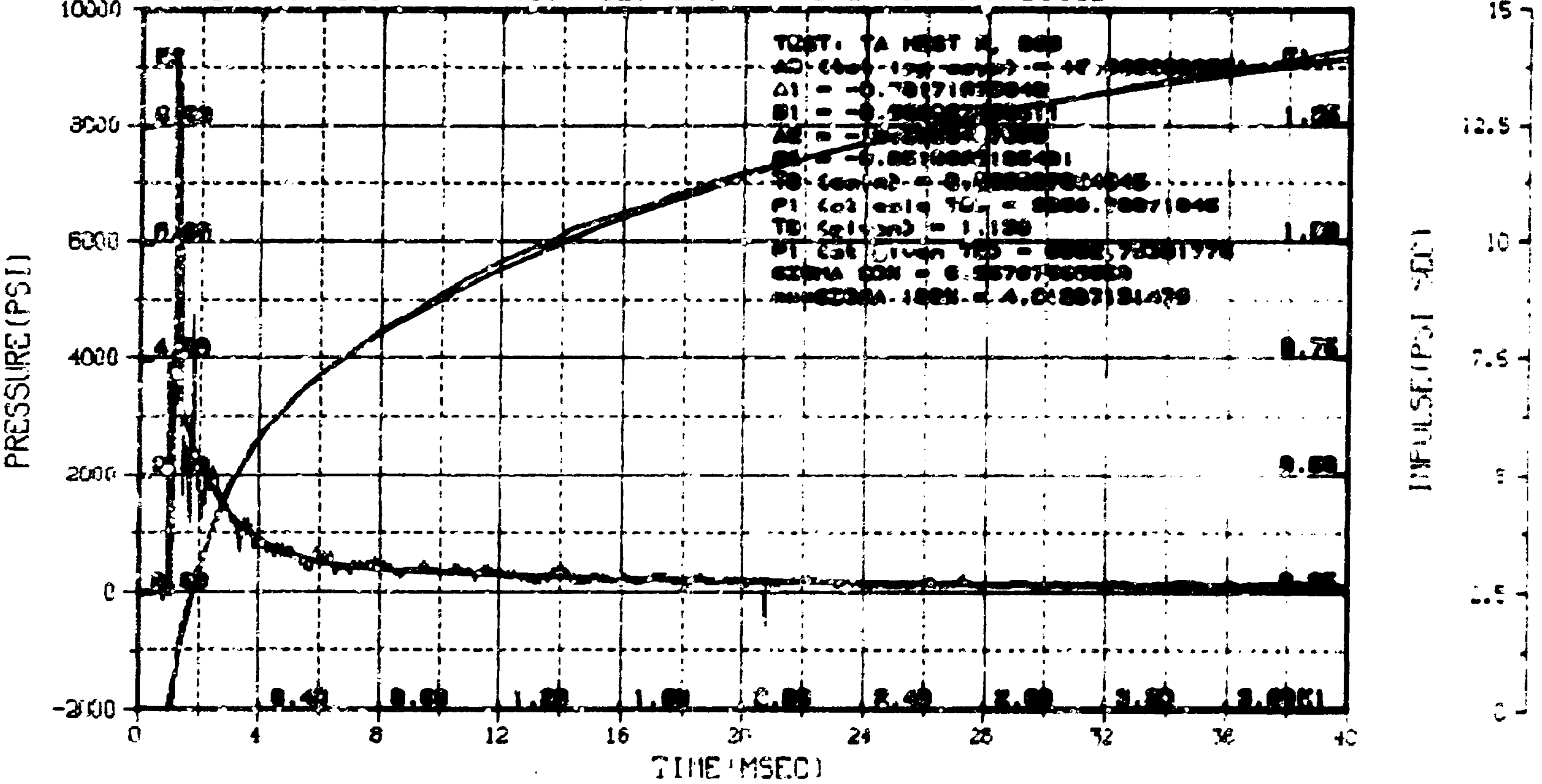
M.N. = 6
TSKIP=15.110
S.R. =100.00 KHZ

E.U. -0.000,5416.600
DIGITS=0.000,392.500
9 00 AM,29 MAR

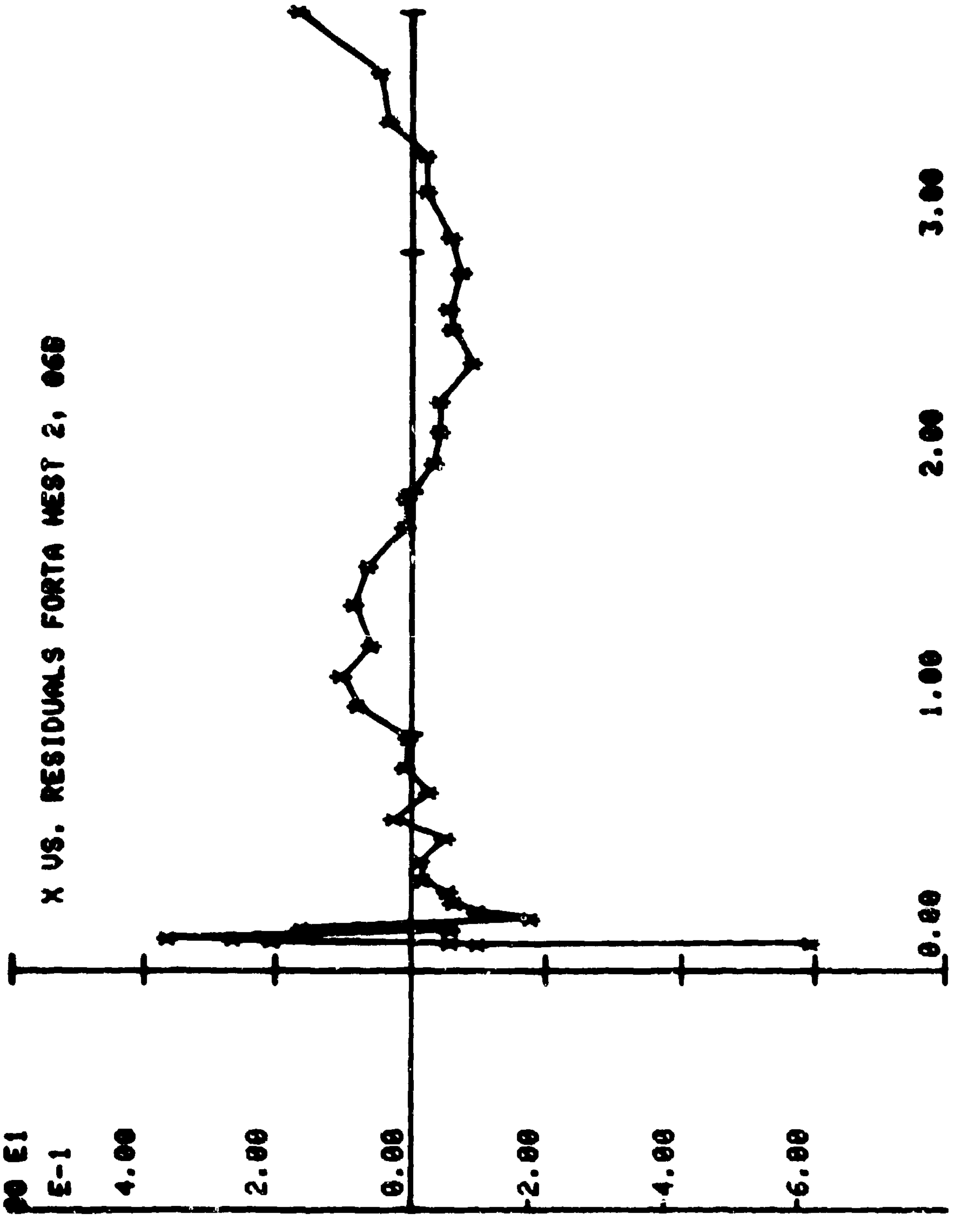
VSN-
TAPE
FILE-

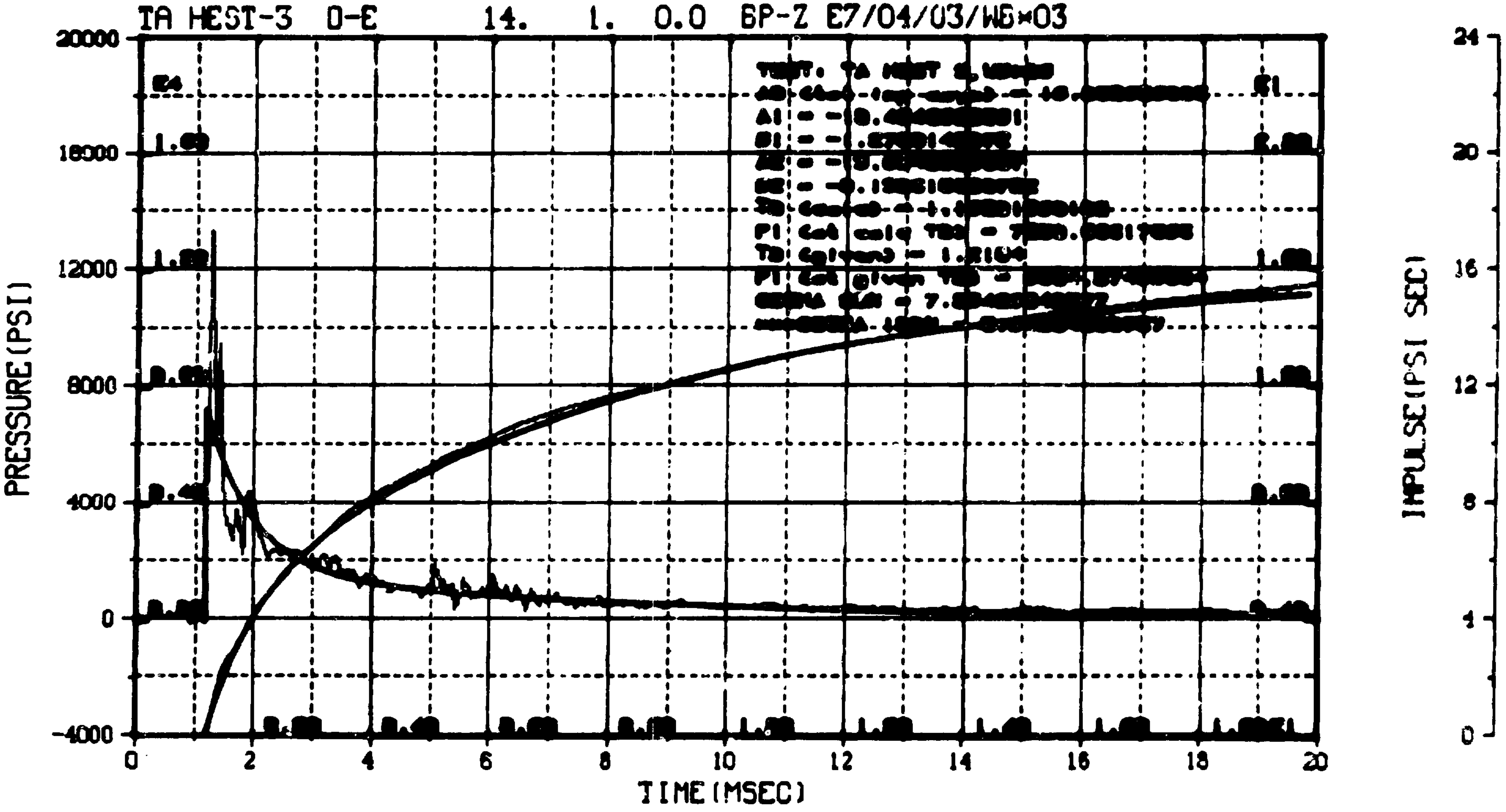

X VS. RESIDUALS FORTA WEST 2, 03%
E1
E-1
2.00
0.00
-2.00
-4.00
0.00
0.50
1.00
1.50
2.

IA HEST-2 D-E- -36. -12. 0.0 BP-Z E7/04/11/WB$068

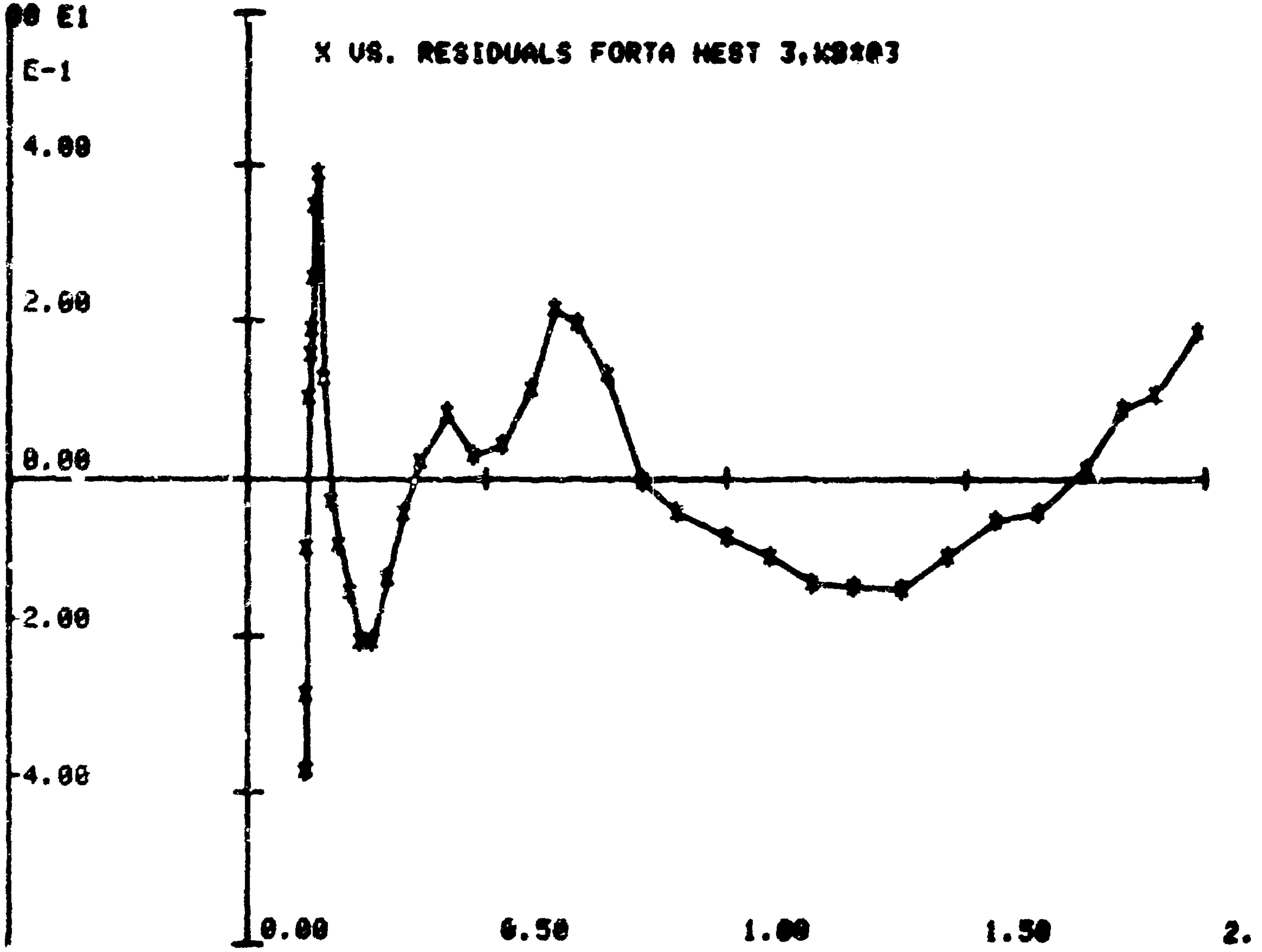


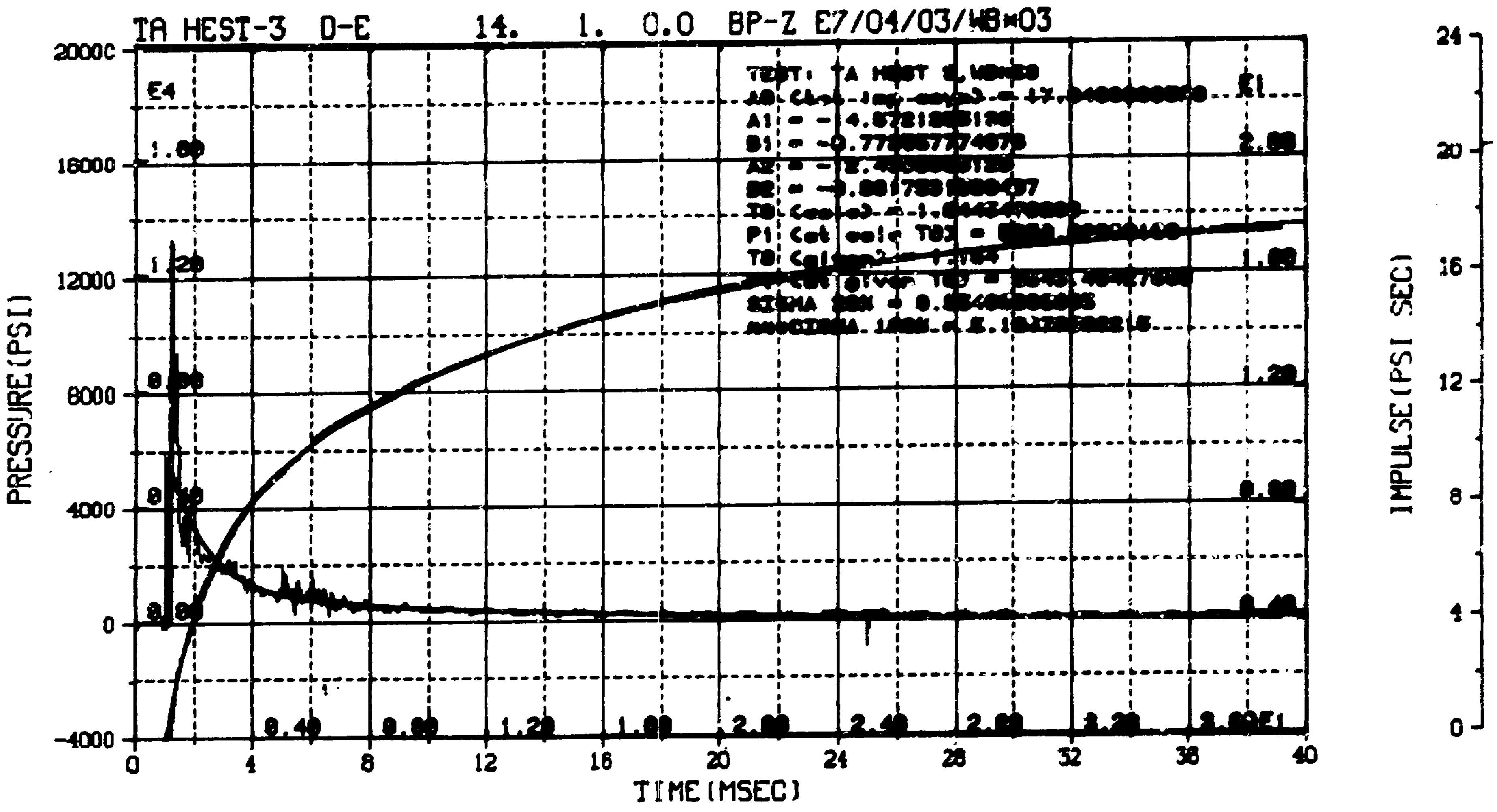
M.N. = 435 5 E.U. =0.000,5416.600 VSN-
TSKIP=15.110 DIGITS=0.000,392.500 TAPE22
S.R. =100.00 KHZ 10 04 PM,28 MAR 76. FILE=66

X VS. RESIDUALS FORTA WEST 2, 06B
00 E1
E-1
4.00
2.00
0.00
-2.00
-4.00
-6.00
0.00
1.00
2.00
3.00
4.

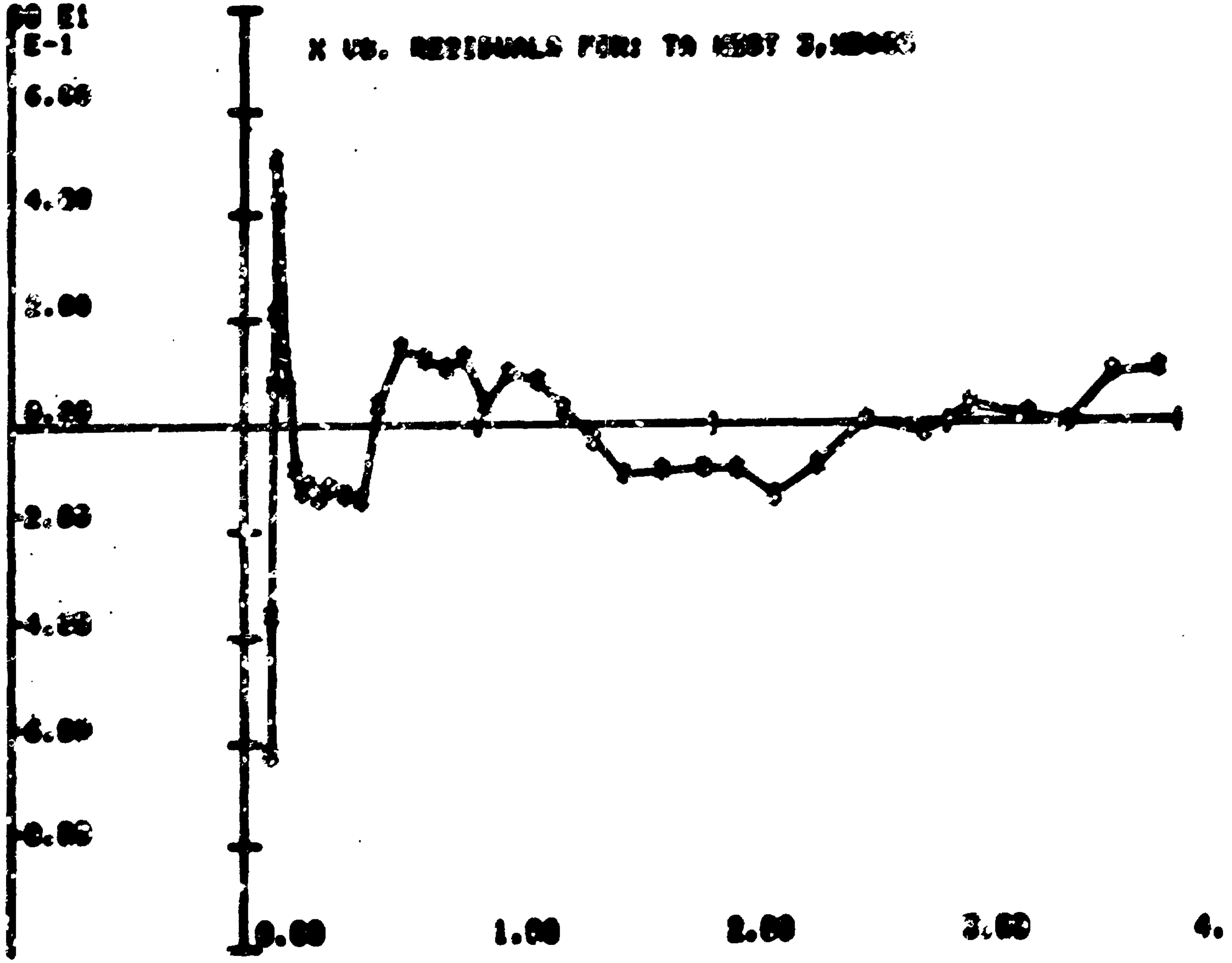


```
M.N. -     3        E.U.   -0.000,7820.000      VSN-  ED23
TSKIP-12.650        DIGITS-0.000,746.875        TAF222
S.R. -100.00 KHZ     11 36 AM, 2 MAY 78.        FILE-36
```

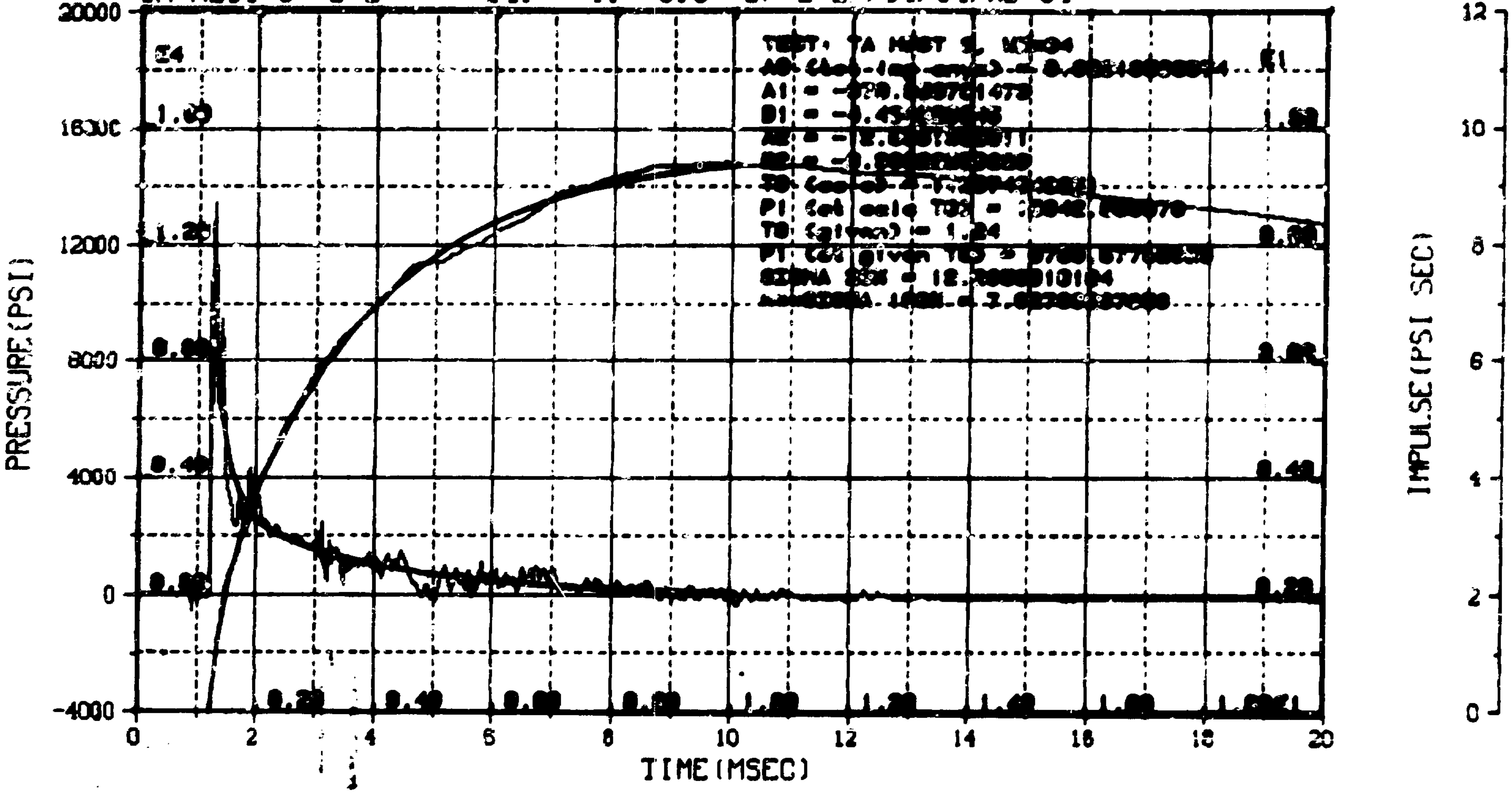

X VS. RESIDUALS FORTA WEST 3,XB*03
00 E1
E-1
4.00
2.00
0.00
-2.00
-4.00
0.00
0.50
1.00
1.50
2.



M.N. = 3 E.U. =0.000,7820.000 VSN=
TSKIP=12.650 DIGITS=0.000,746.875 TAPE22
S.R. =100.00 KHZ 8 50 AM, 2 MAY 78. FILE=36
1


X VS. RESIDUALS FOR: TO [illegible] 3,[illegible]
E1
E-1
6.00
4.00
2.00
0.00
-2.00
-4.00
-6.00
-8.00
0.00
1.00
2.00
3.00
4.

TA HEST-3 D-E 14. -1. 0.0 BP-Z E7/04/04/HB-04

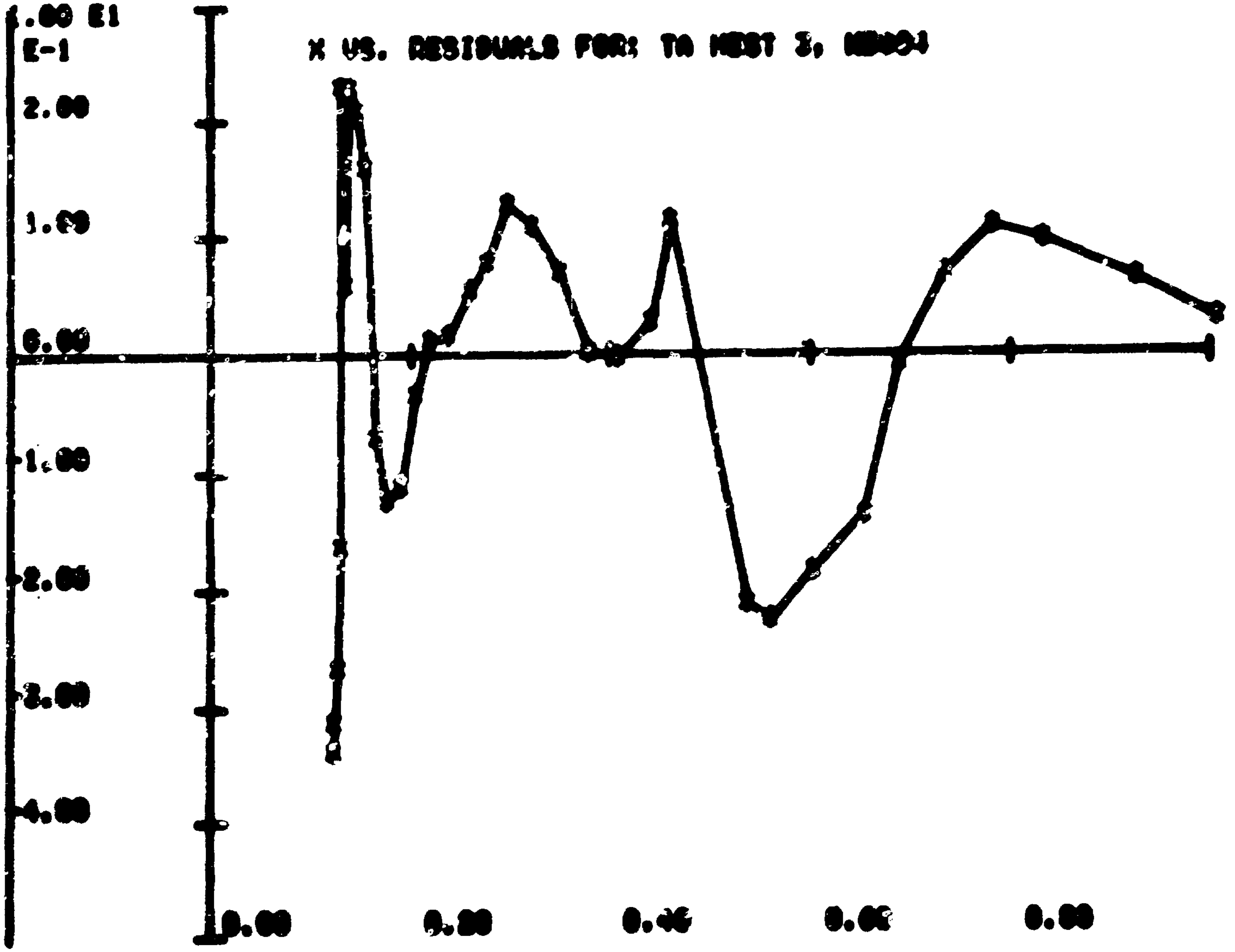


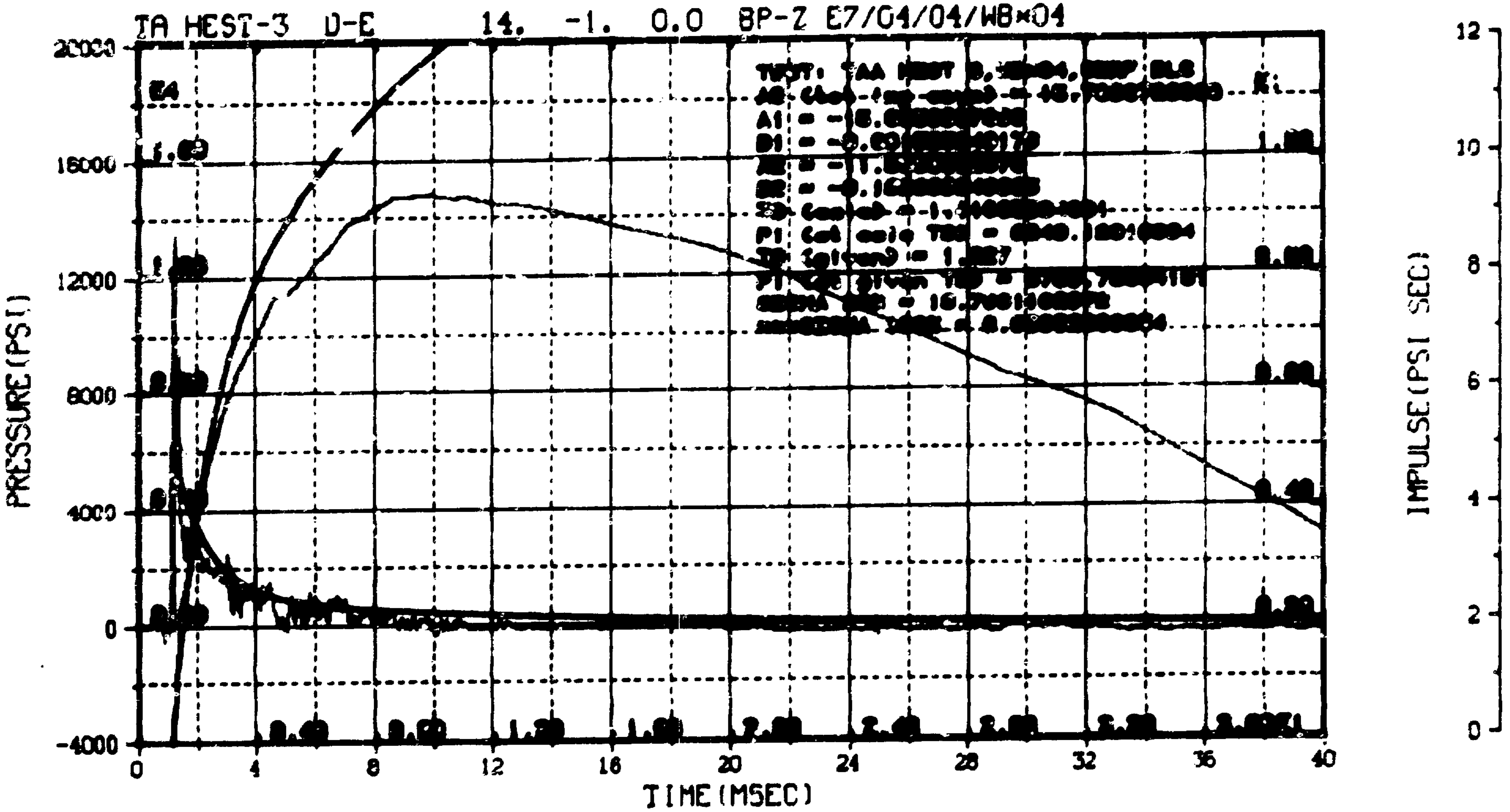
M.N. = 4
TSKIP=12.650
S.R. =100.00 KHZ

E.U. =0.000,9265.000
DIGITS=0.000,692.000
11 36 AM, 2 MAY 78.

VSN= CC23
TAPE22
FILE=38

1

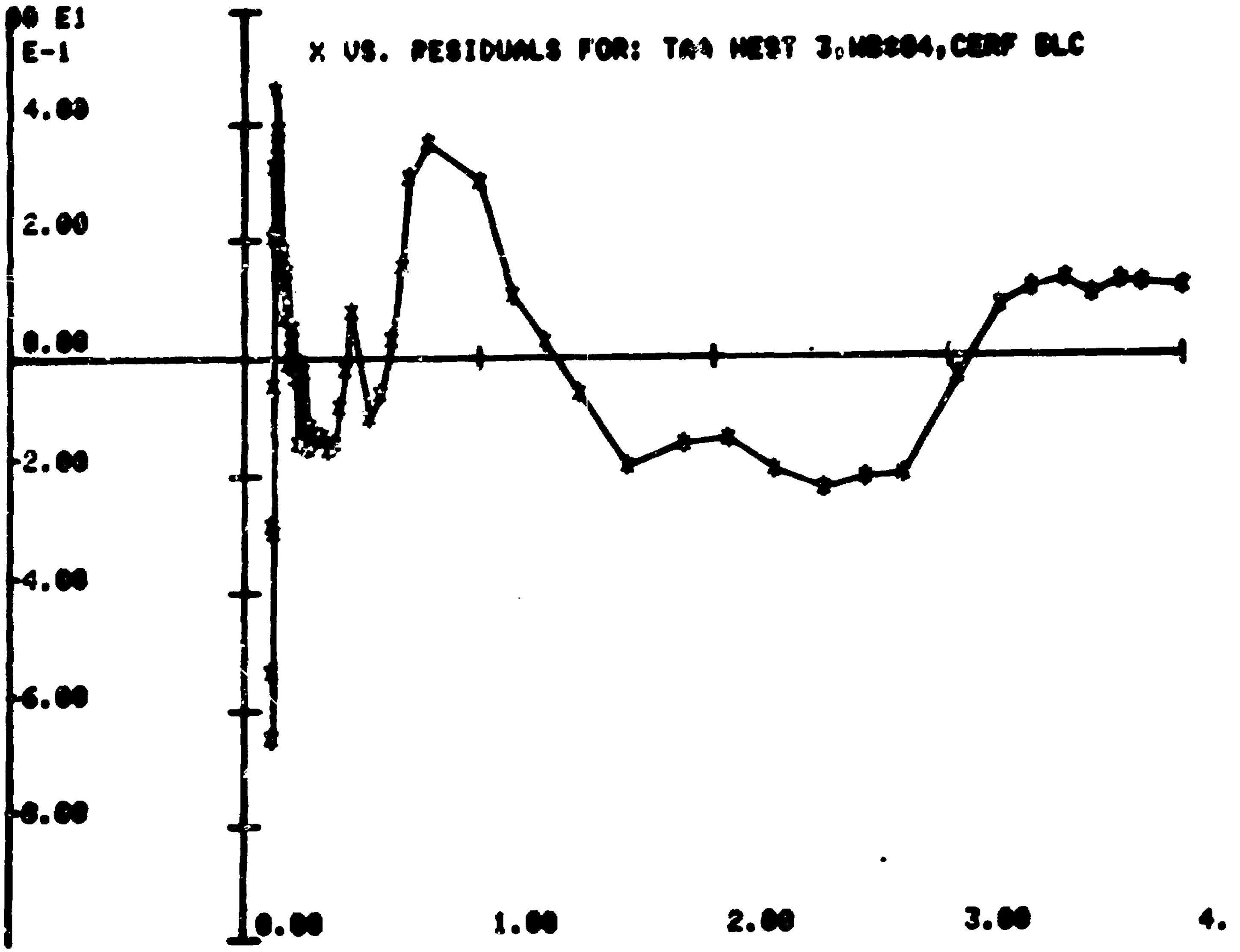

X VS. RESIDUALS FOR: TA HEST 3, [illegible]
1.00 E1
E-1
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
0.00
0.20
0.40
0.60
0.80

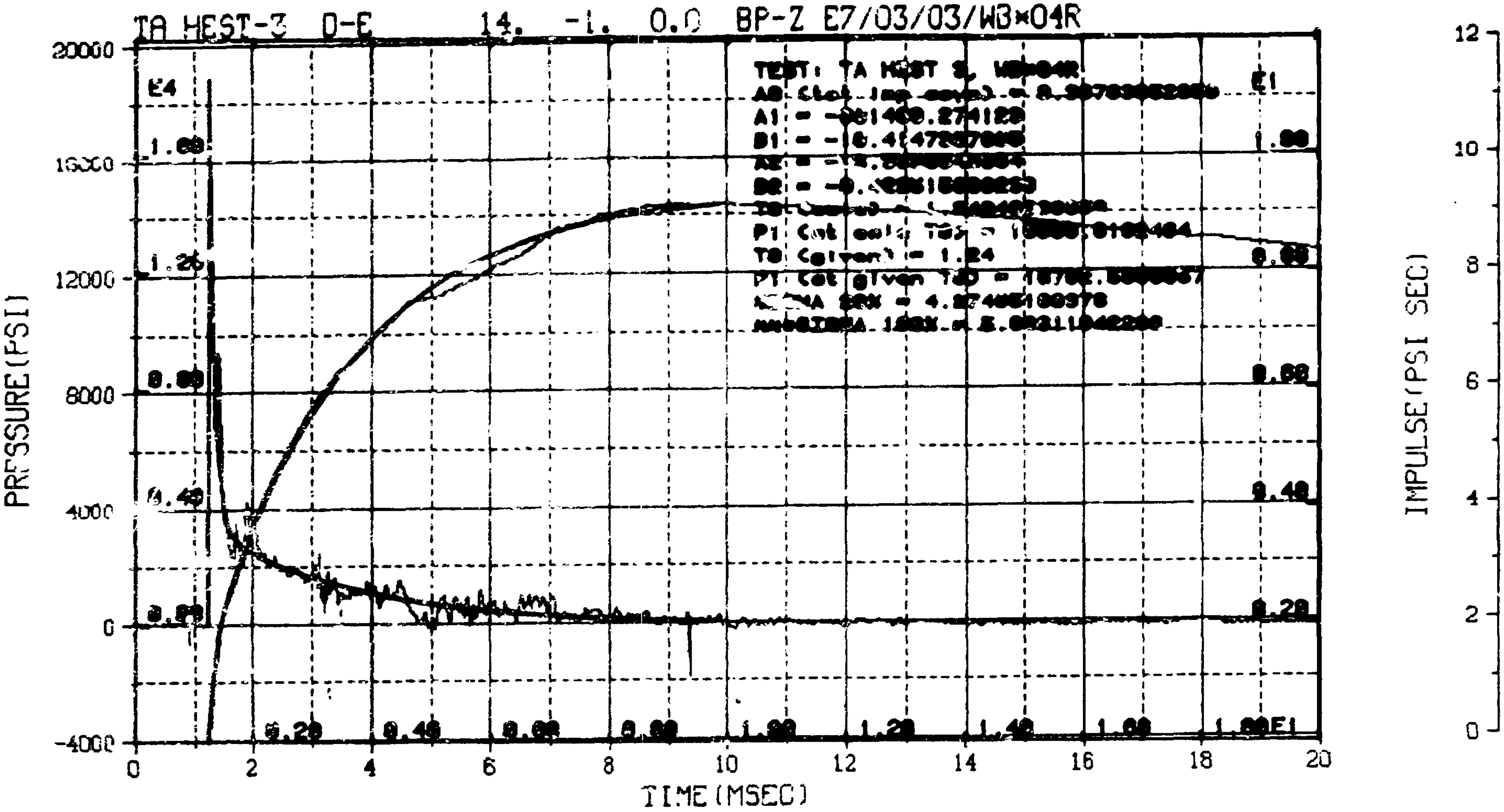


M.N. = 4
TSKIP-12.650
S.R. =100.00 KHZ

E.U. =0.000,9265.000
DIGITS=0.000,692.000
8 50 AM, 2 MAY 78.

VSN=
TAPE22
FILE=38


X VS. RESIDUALS FOR: TA4 WEST 3,WB204,CERF BLC
00 E1
E-1
4.00
2.00
0.00
-2.00
-4.00
-6.00
-8.00
0.00
1.00
2.00
3.00
4.

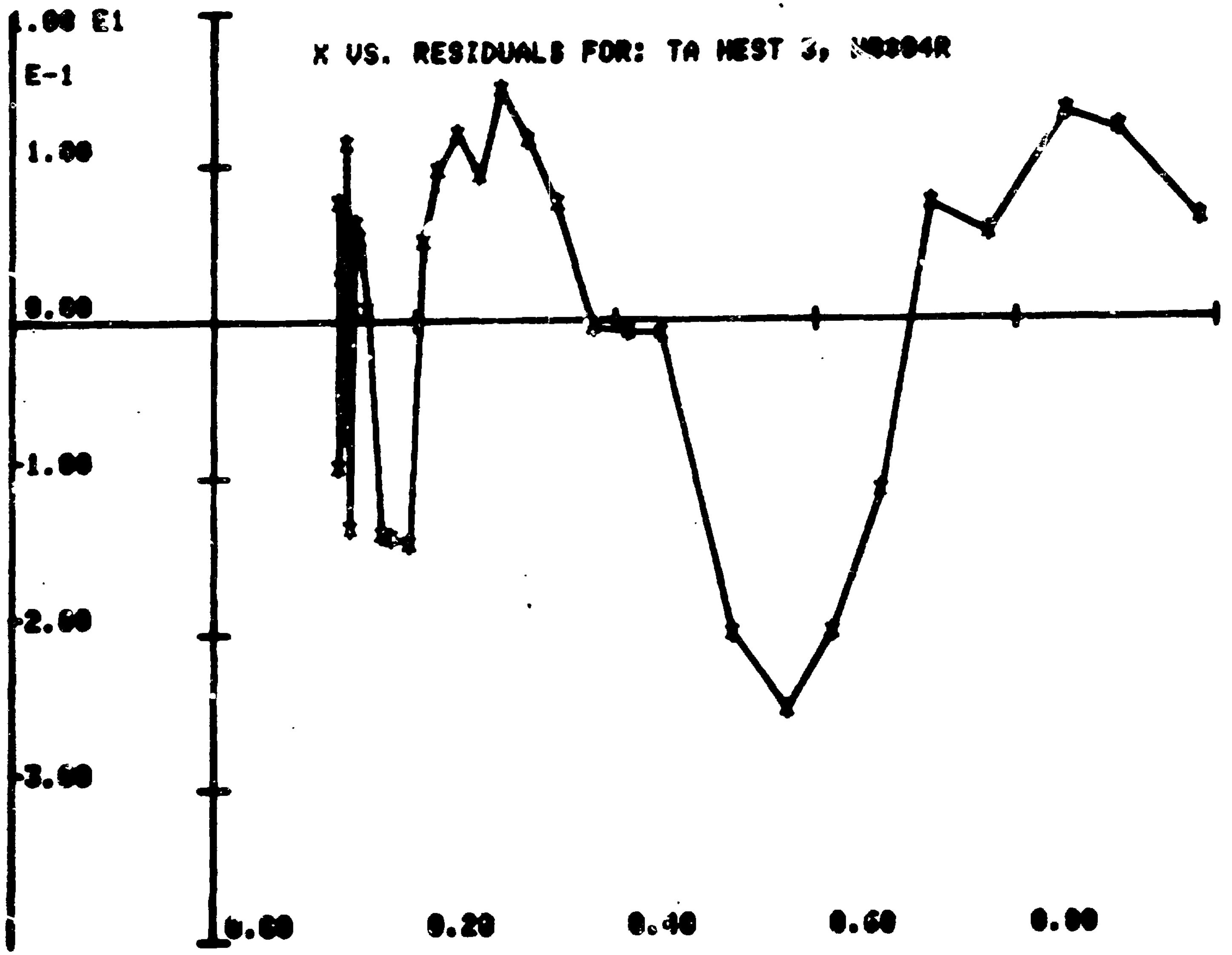


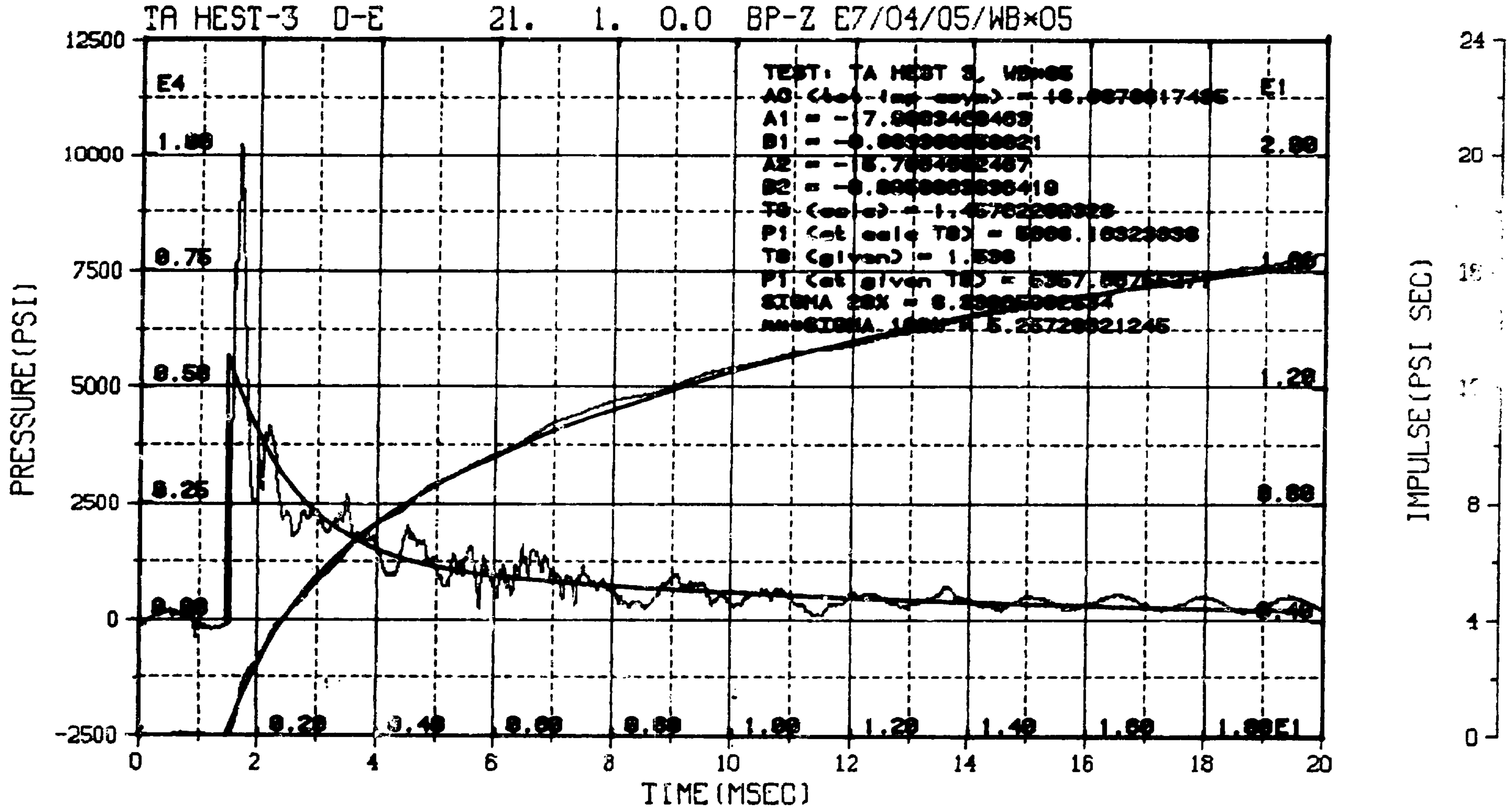
M.N. = 4
TSKIP=12.640
S.R. =100.00 KHZ

E.U. =0.000,9265.000
DIGITS=0.000,680.000
8 50 AM, 2 MAY 78.

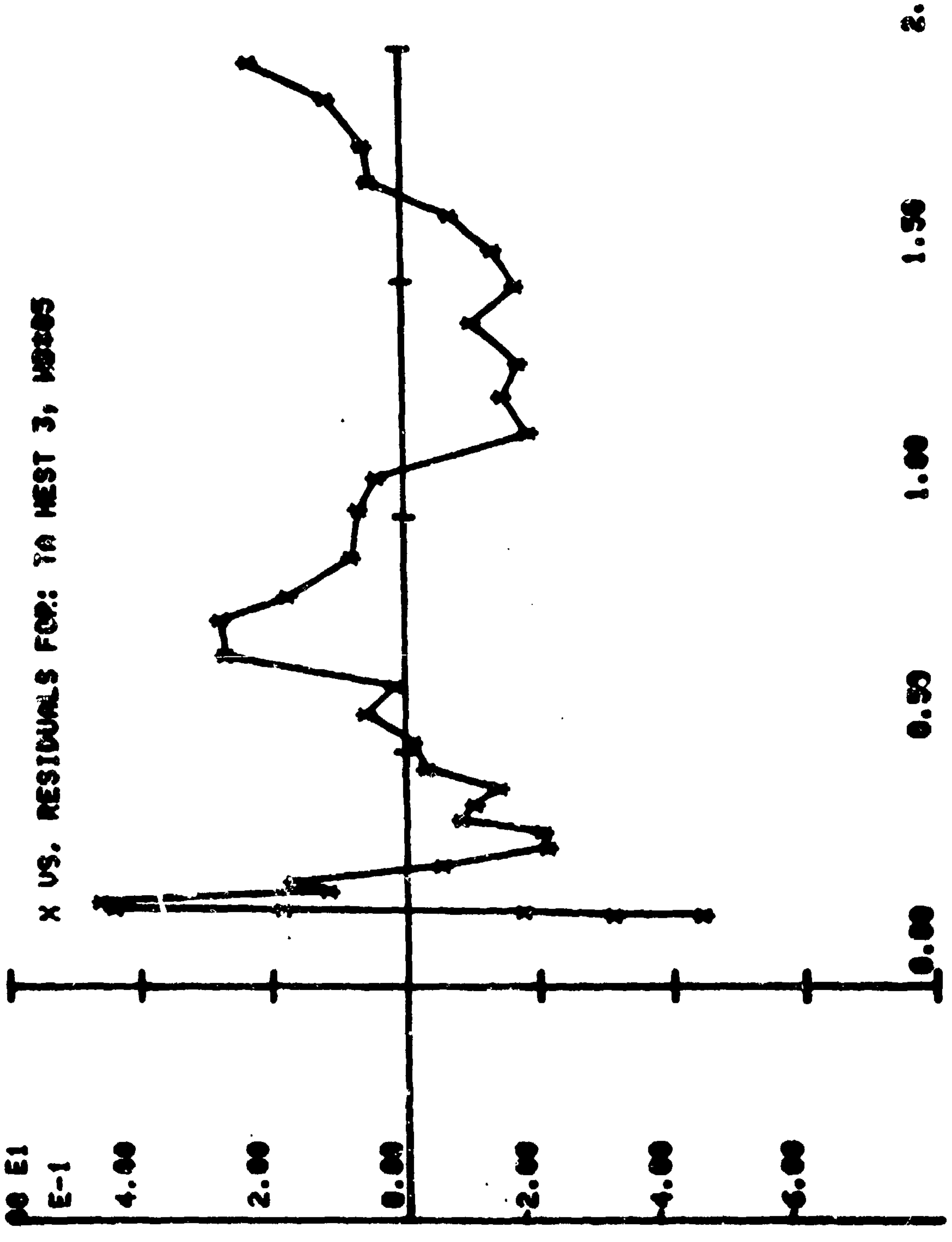
VSN=
TAPE22
FILE=24

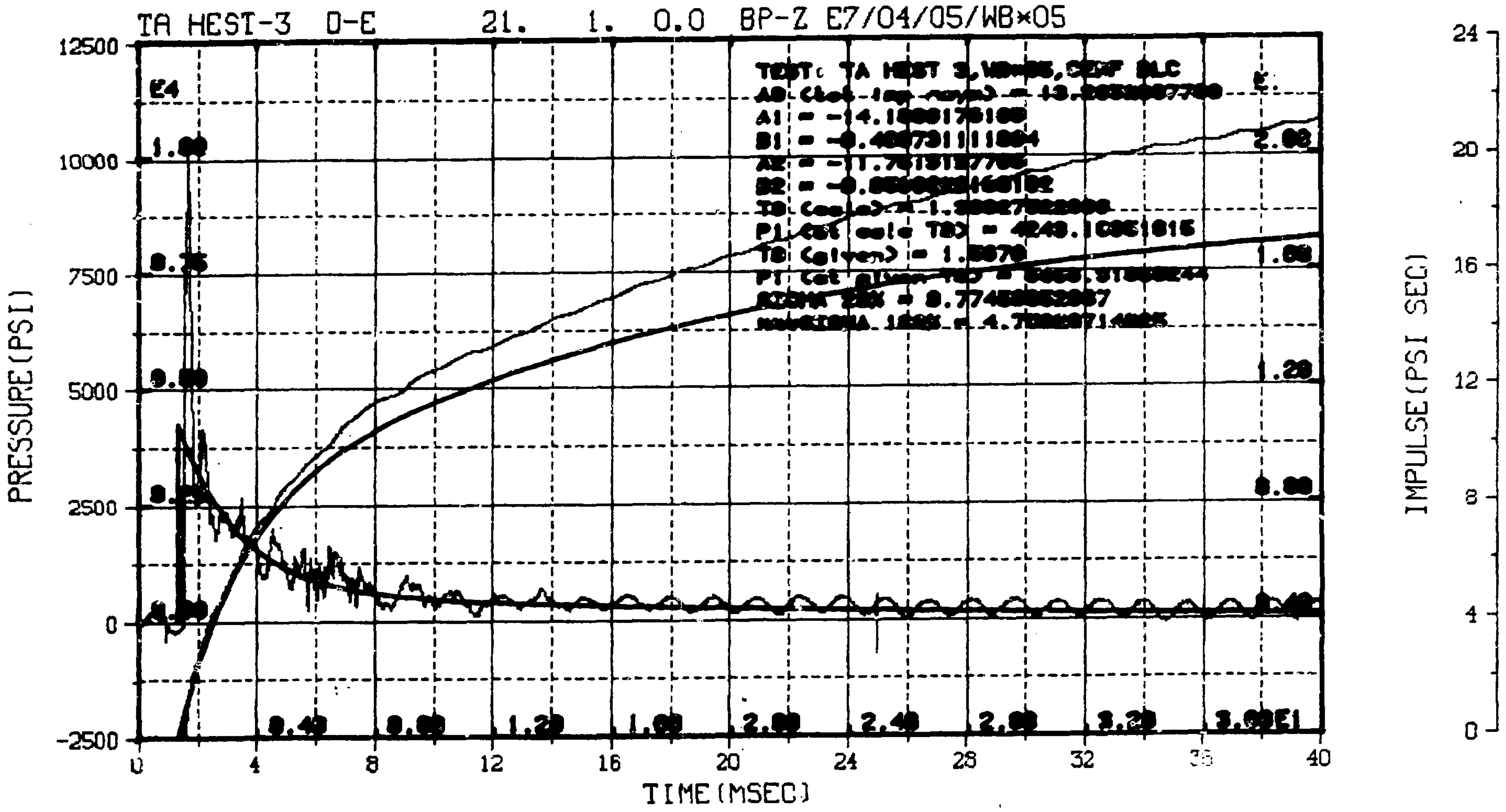
1


X VS. RESIDUALS FOR: TA WEST 3, [illegible]R
.00 E1
E-1
1.00
0.00
-1.00
-2.00
-3.00
0.00
0.20
0.40
0.60
0.80



M.N. = 5 E.U. =0.000,7095.000 VSN= ED23
TSKIP=12.650 DIGITS=0.000,756.000 TAPE22
S.R. =100.00 KHZ 11 36 AM, 2 MAY 78. FILE=40
1


X VS. RESIDUALS FOR: TA WEST 3, WORDS
00 E1
E-1
4.00
2.00
0.00
-2.00
-4.00
-6.00
0.00
0.50
1.00
1.50
2.

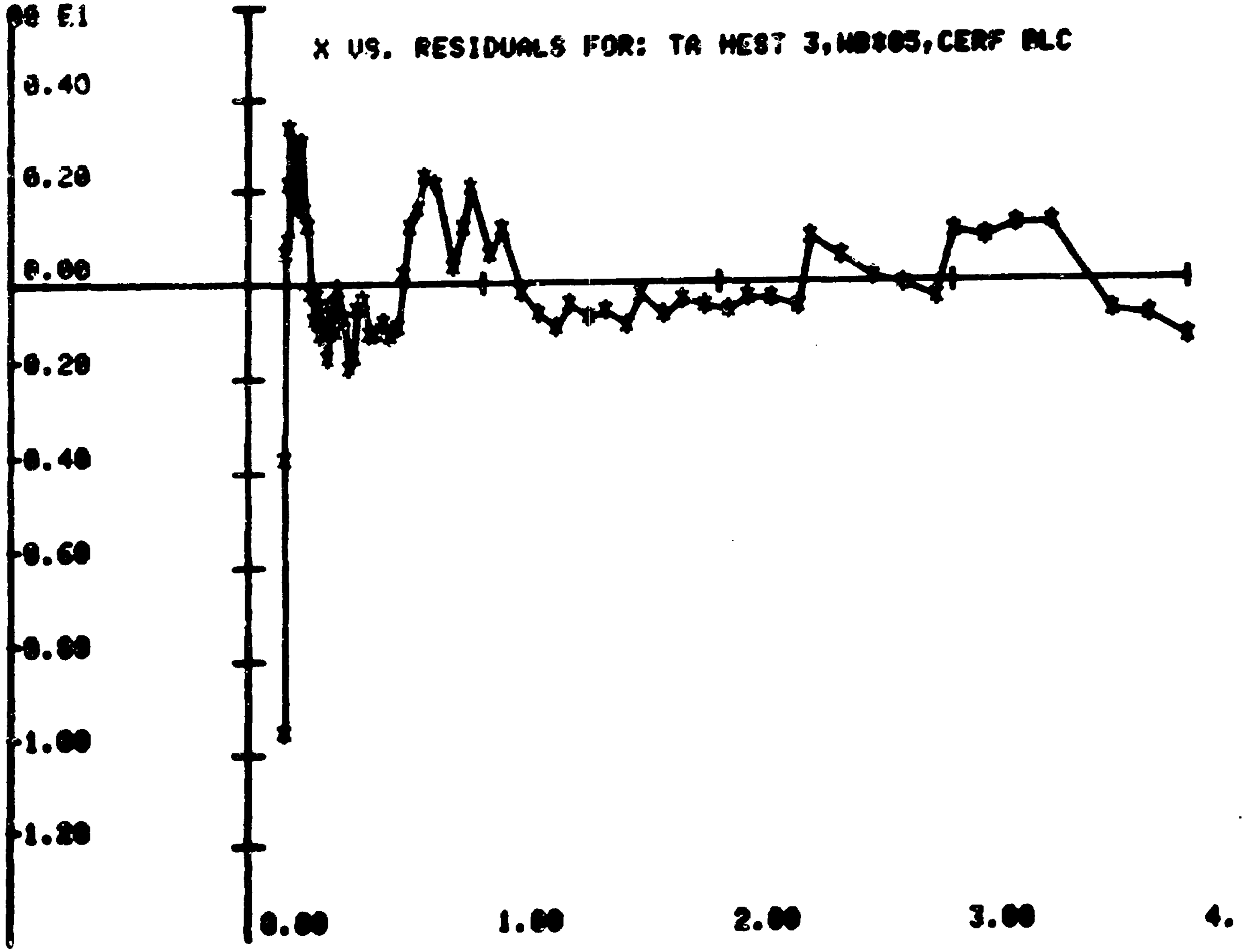


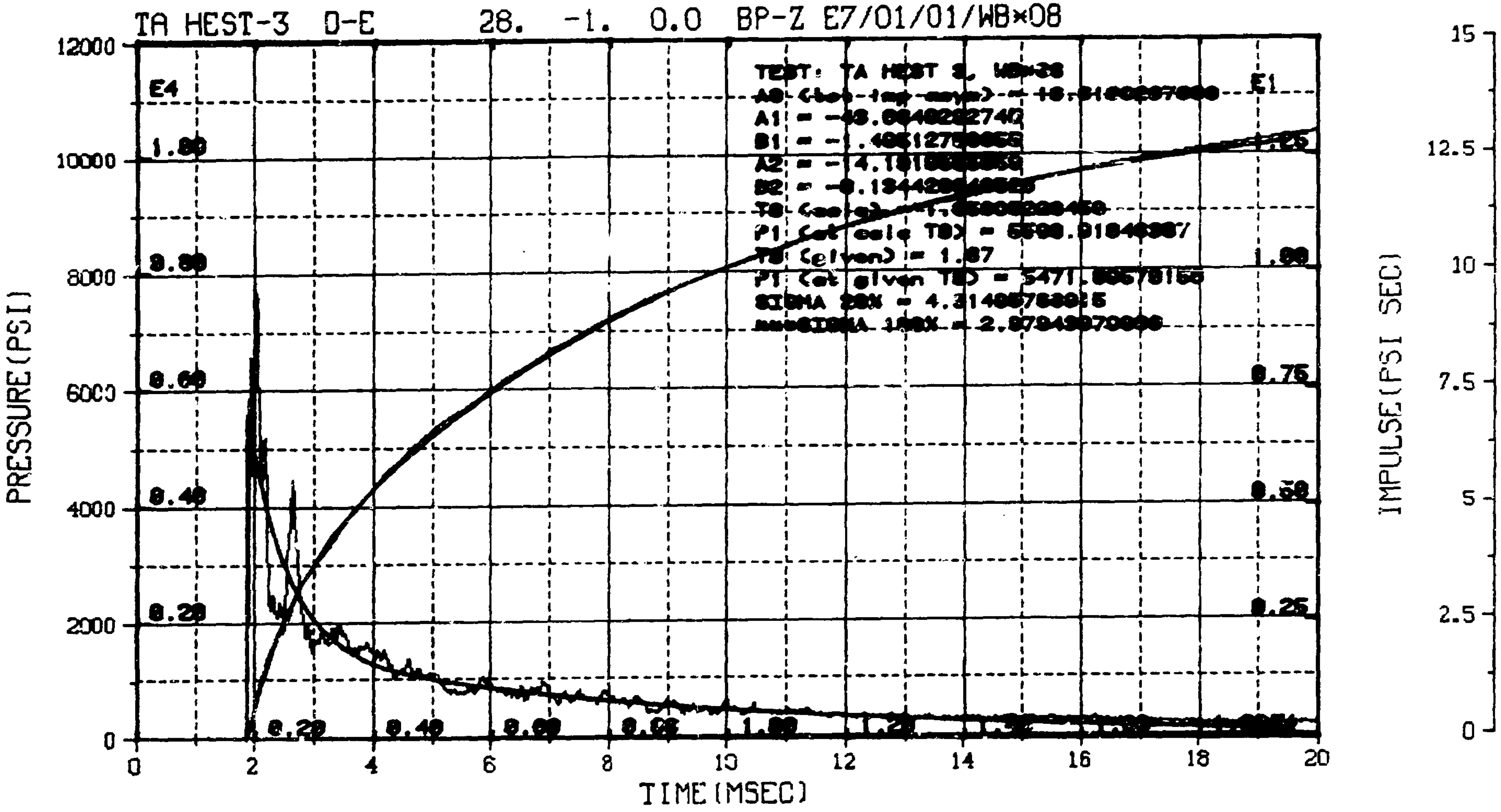
M.N. = 5
TSKIP '2.650
S.R. =100.00 KHZ

E.U. =0.000,7095.000
DIGITS=0.000,756.000
8 50 AM, 2 MAY 78.

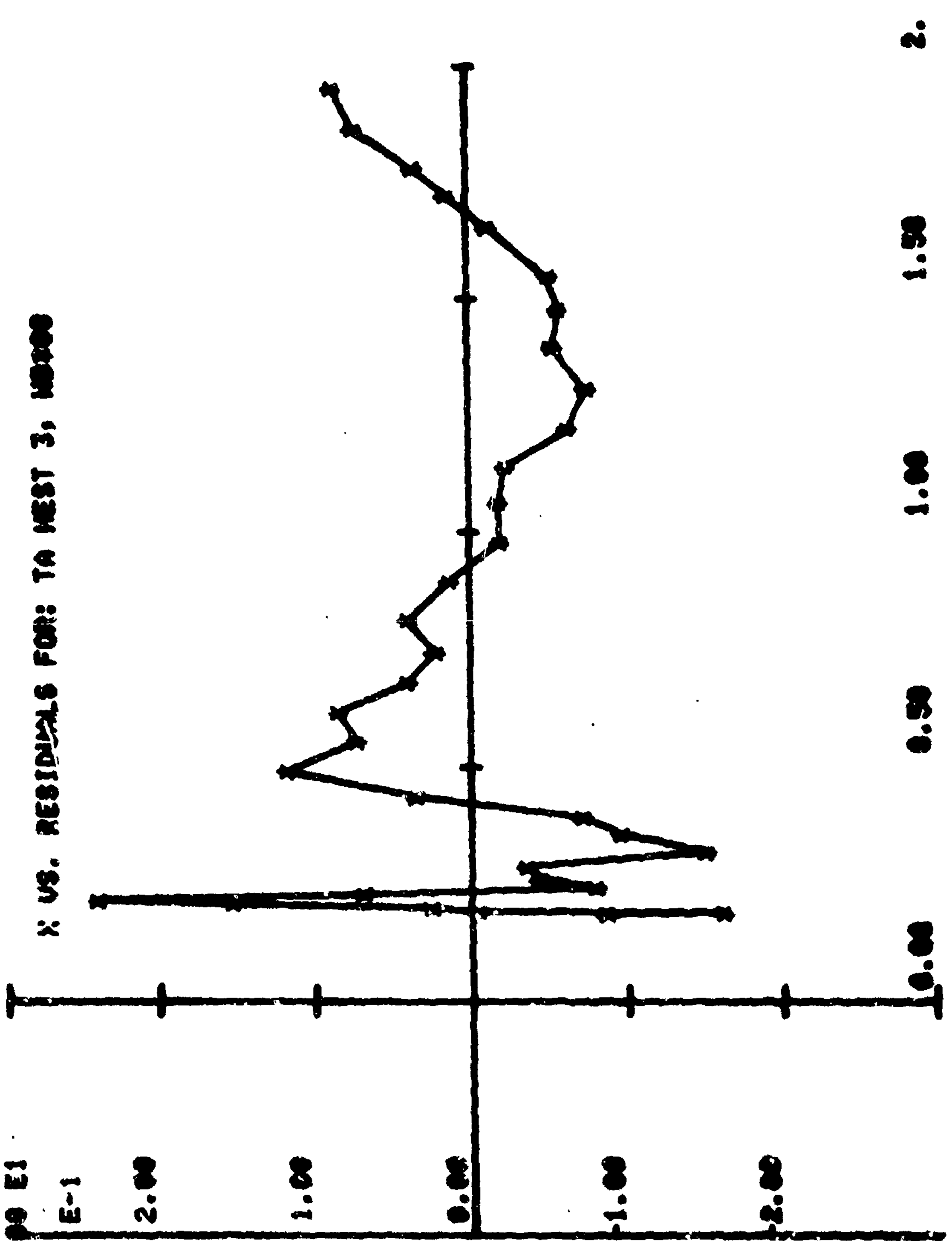
VSN=
TAPE22
FILE=40

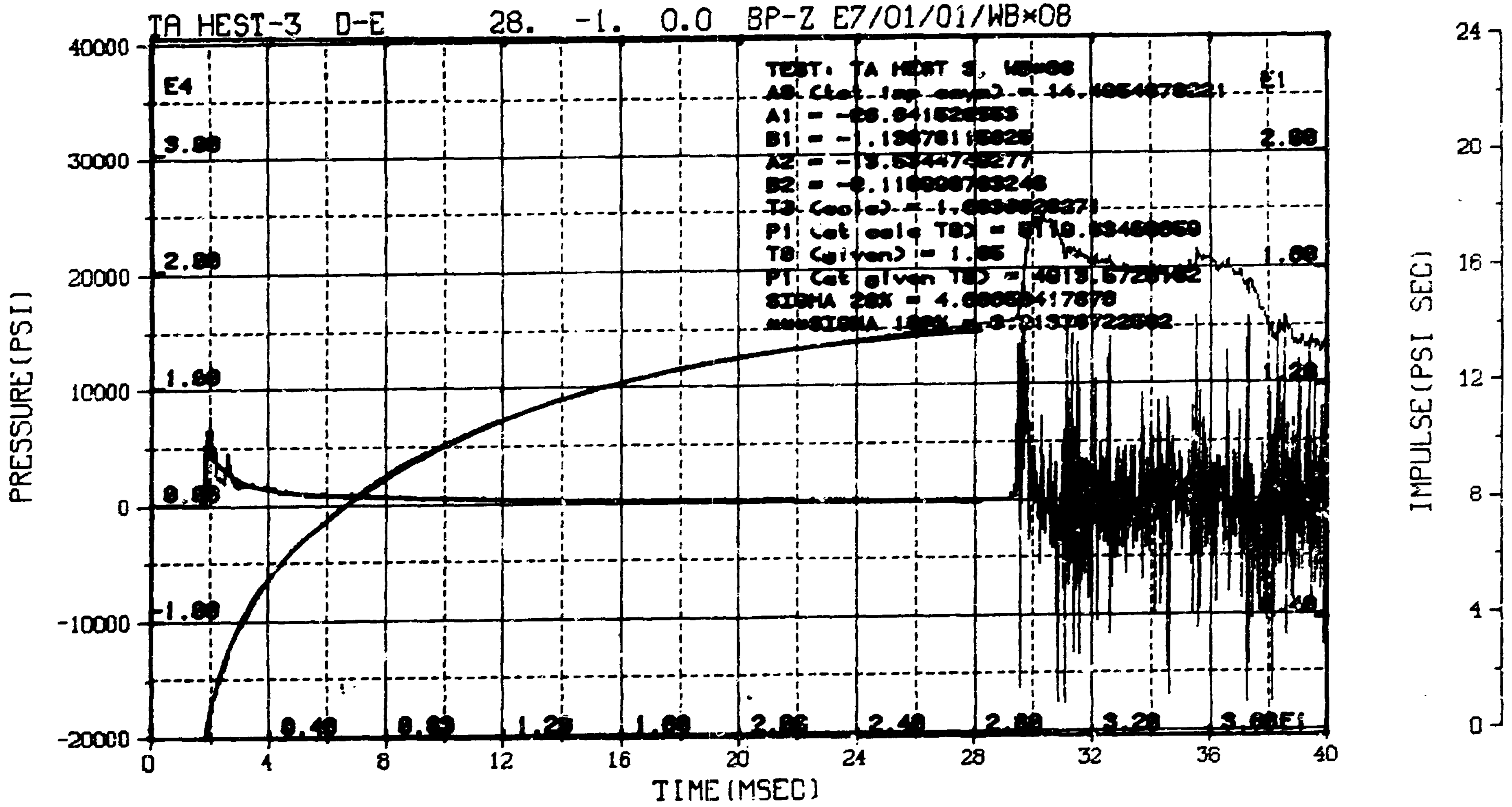
1


X VS. RESIDUALS FOR: TA WEST 3,WB#05,CERF BLC
00 E1
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
0.00
1.00
2.00
3.00
4.

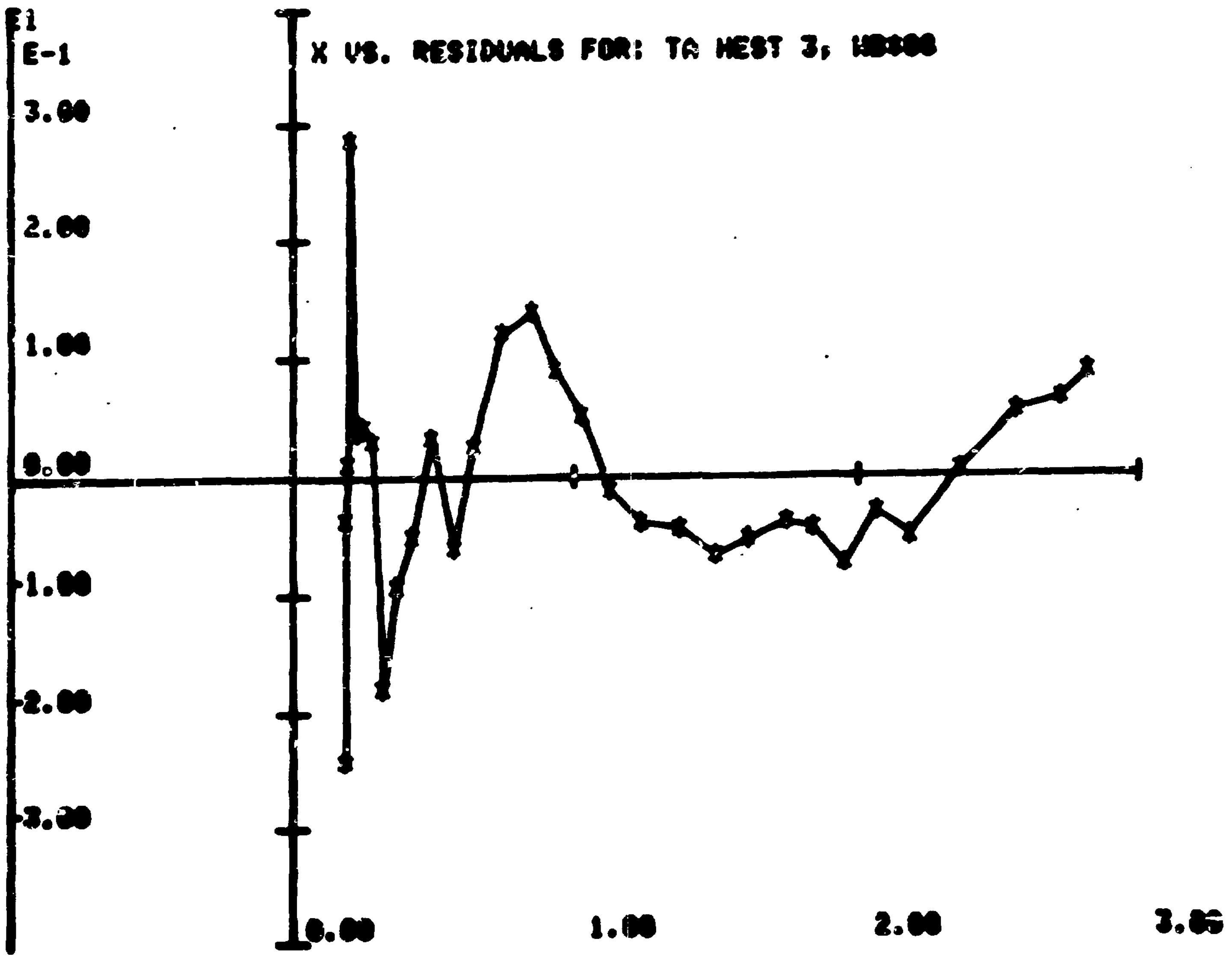


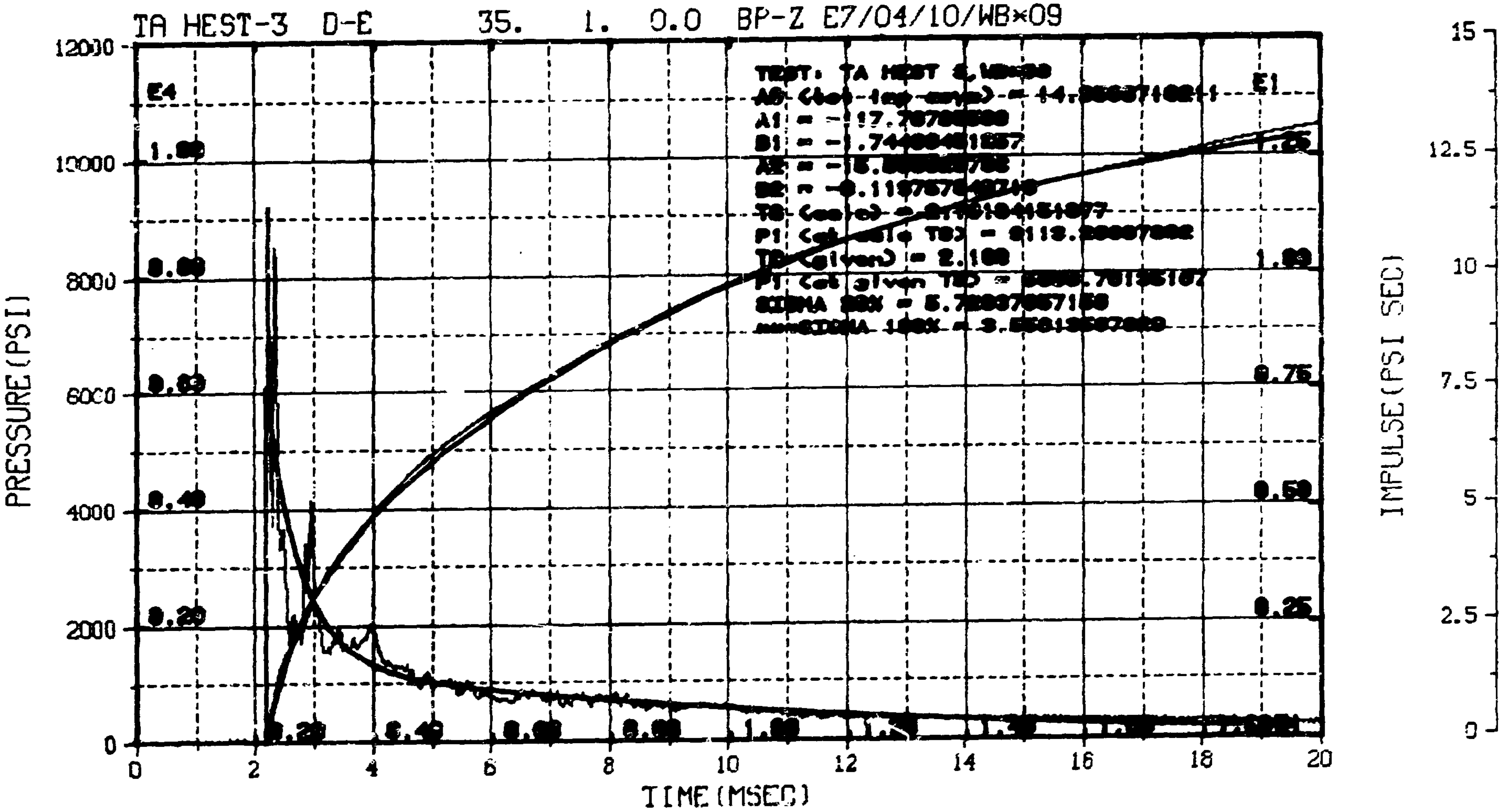
I.N. = 8 E.U. =0.000,6514.000 VSN=
TSKIP=12.640 DIGITS=0.000,764.000 TAPE22
S.R. =100.00 KHZ 8 50 AM, 2 MAY 78. FILE=2
1


X VS. RESIDUALS FOR: TA WEST 3, WD200
00 E1
E-1
2.00
1.00
0.00
-1.00
-2.00
0.00
0.50
1.00
1.50
2.

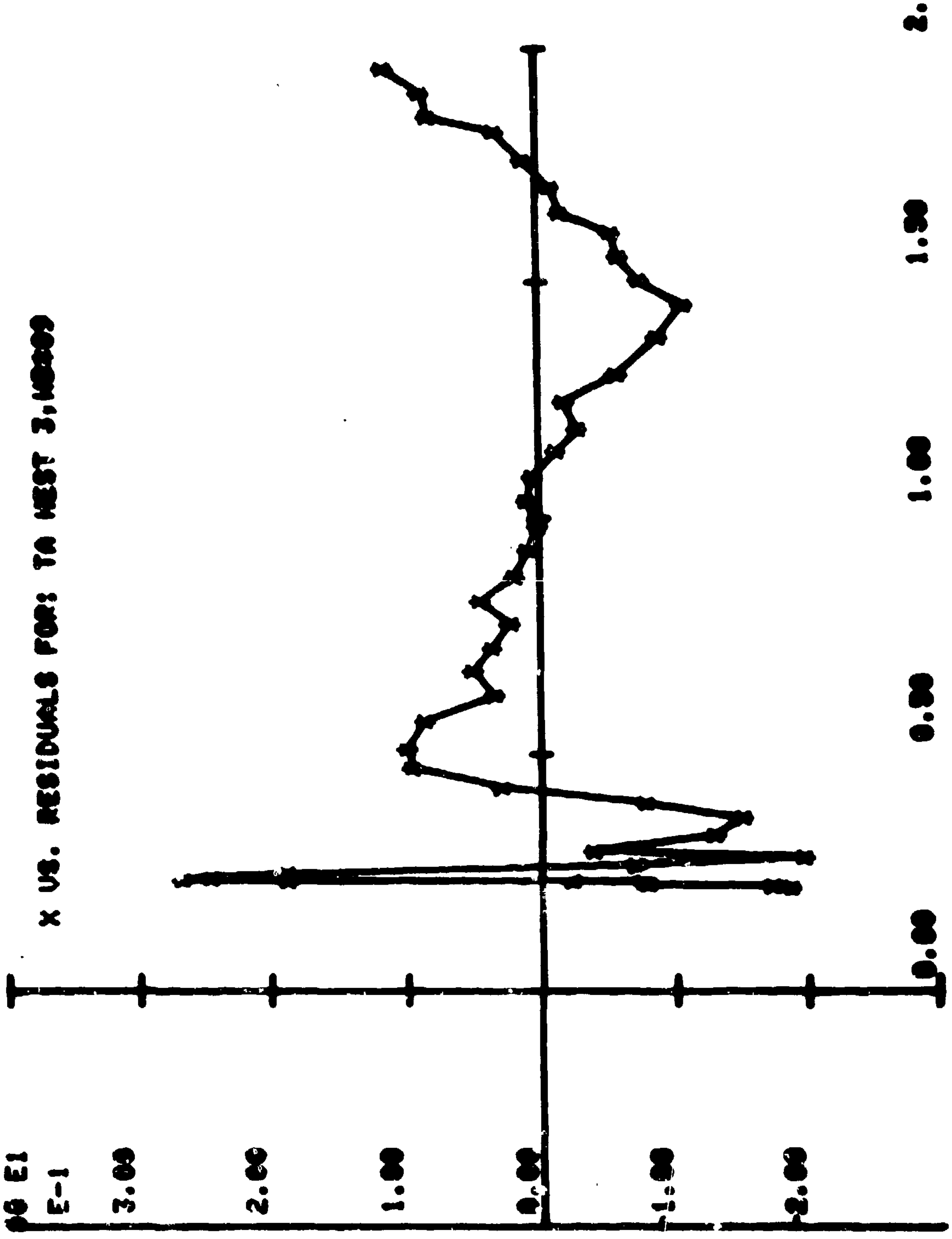


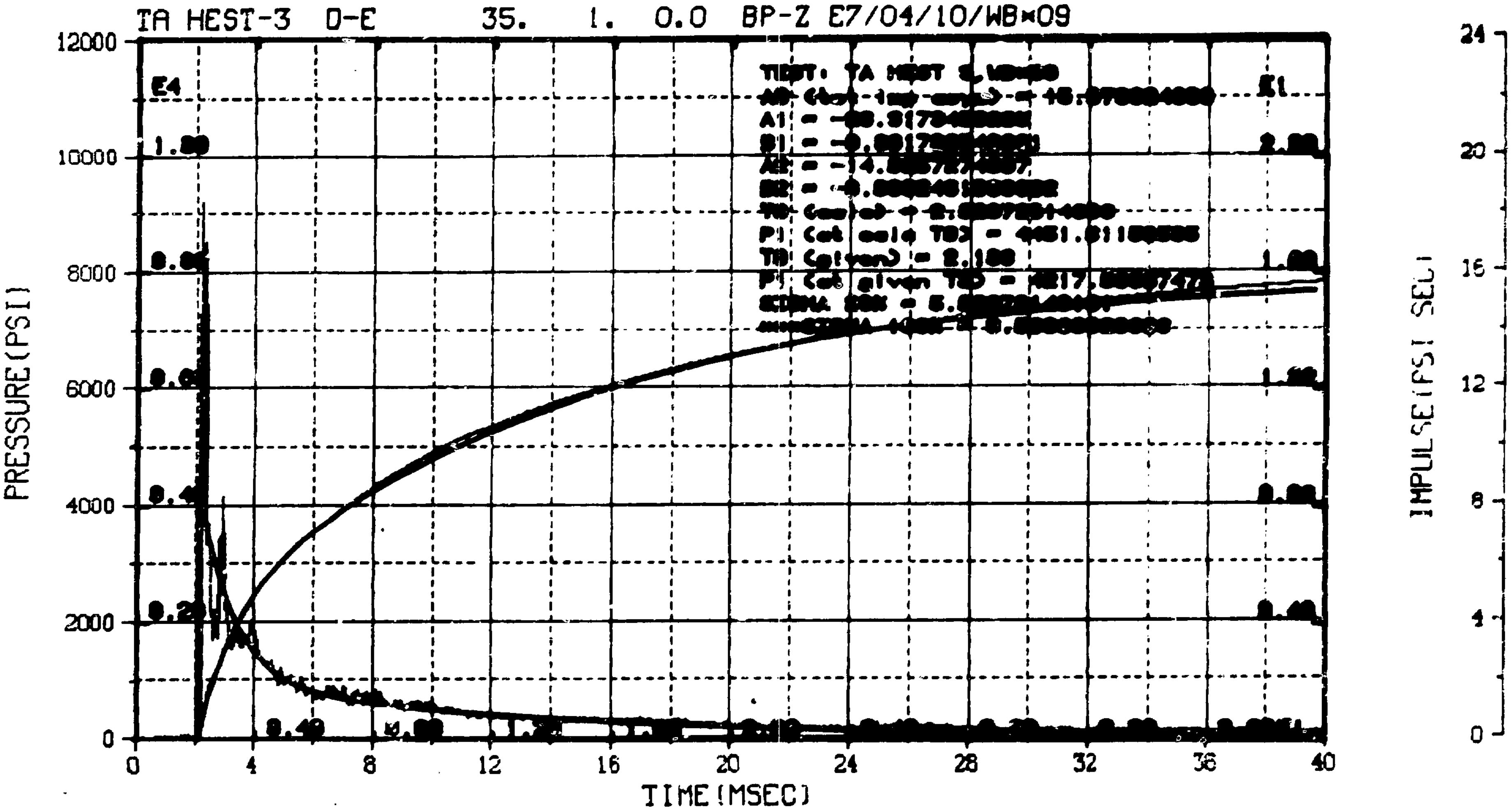
```
M.N. =    8           E.U.   =0.000,6514.000        VSN=
TSKIP=12.640          DIGITS=0.000,764.000          TAPE22
S.R. =100.00 KHZ        8 50 AM, 2 MAY 78.          FILE=2
                                                           1
```


X VS. RESIDUALS FOR: TA WEST 3, [illegible]
E1
E-1
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
0.00
1.00
2.00
3.05



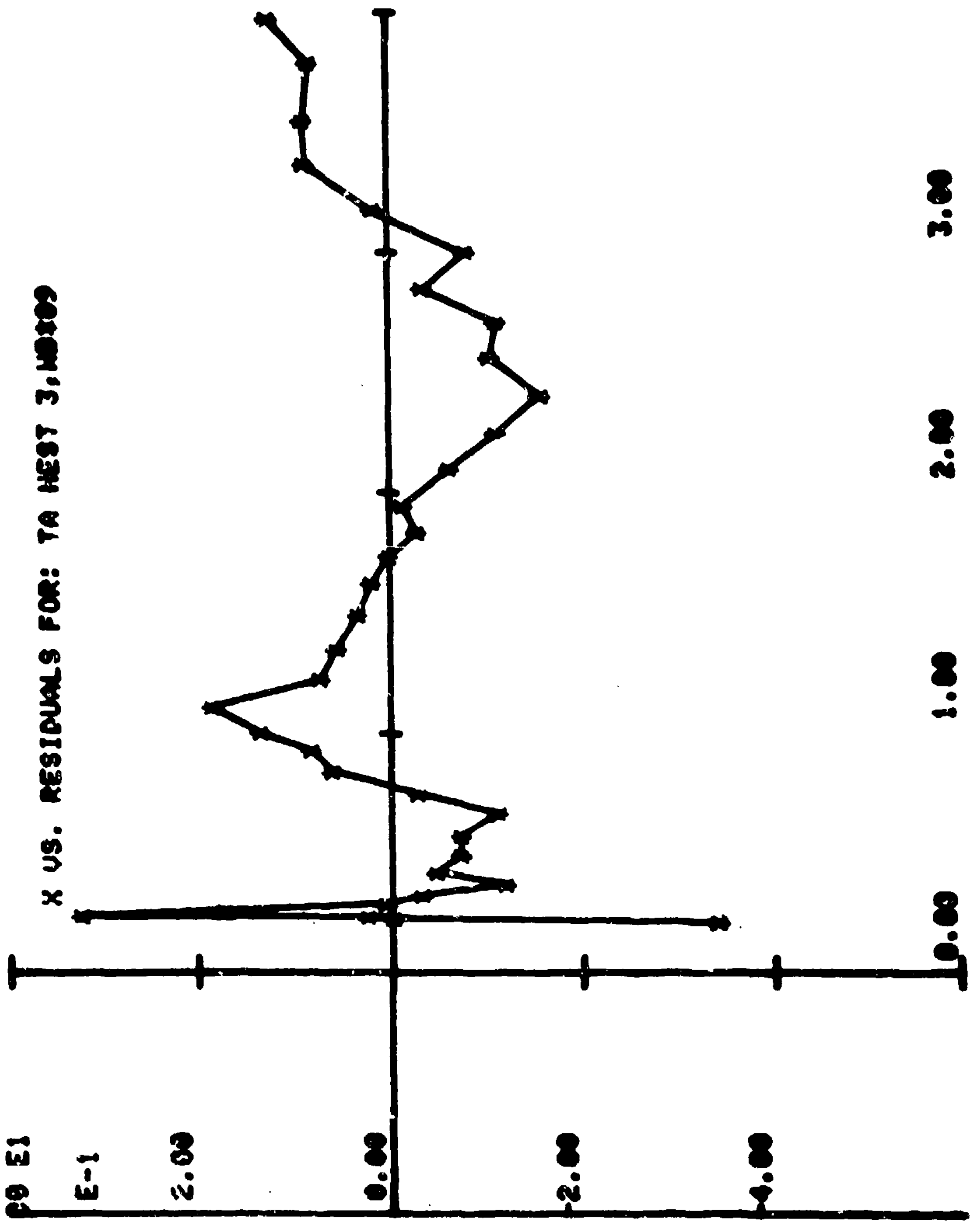
```
M.N. =      9          E.U.   =0.000,6454.000     VSN=  ED23
TSKIP=12.650           DIGITS=0.000,831.500       TAPE22
S.R. =100.00 KHZ        11 36 AM, 2 MAY 78.       FILE=44
                                                           1
```

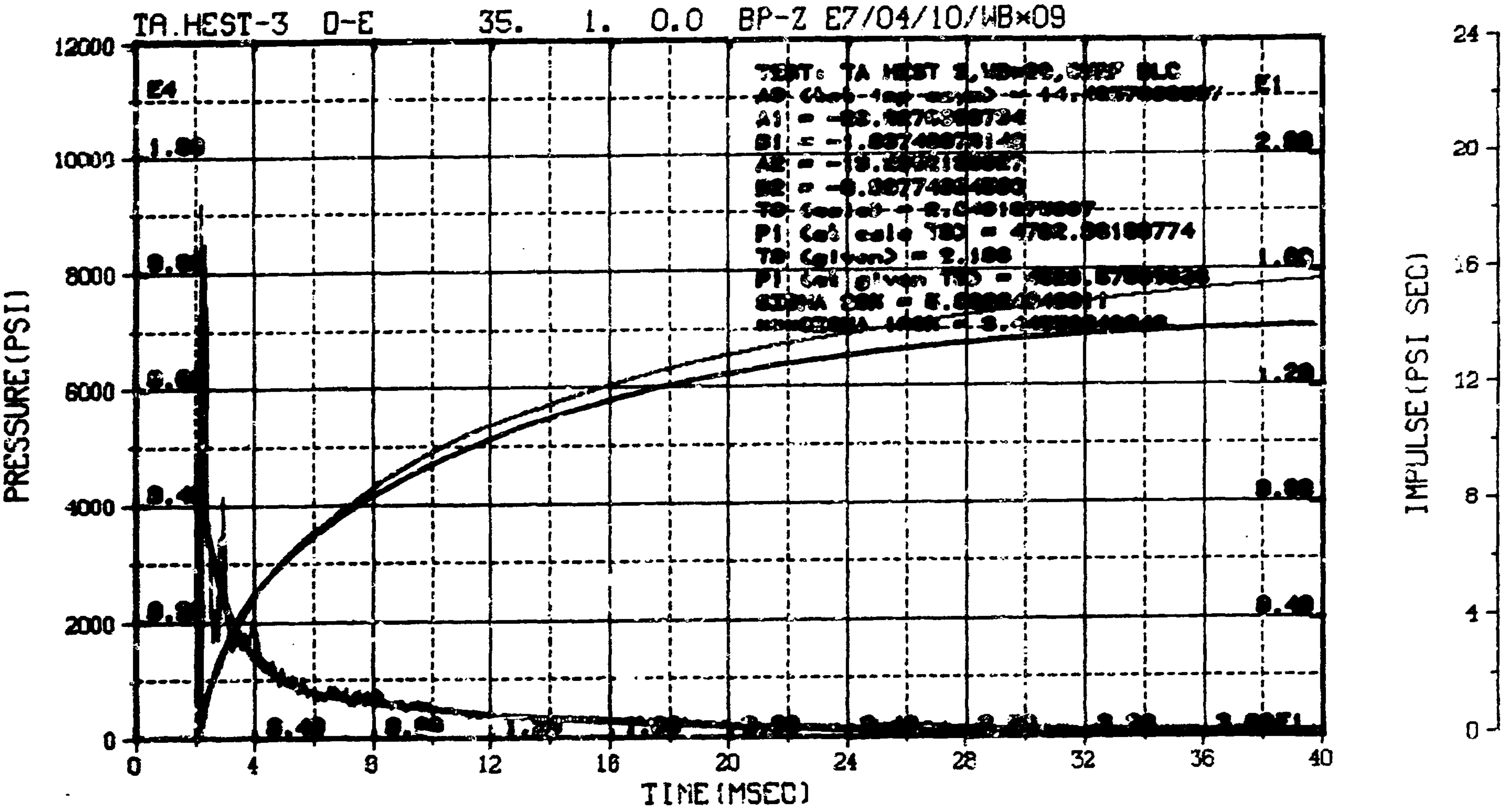

X VS. RESIDUALS FOR: TA WEST 3,MODE09
00 E1
E-1
3.00
2.00
1.00
0.00
-1.00
-2.00
0.00
0.50
1.00
1.50
2.



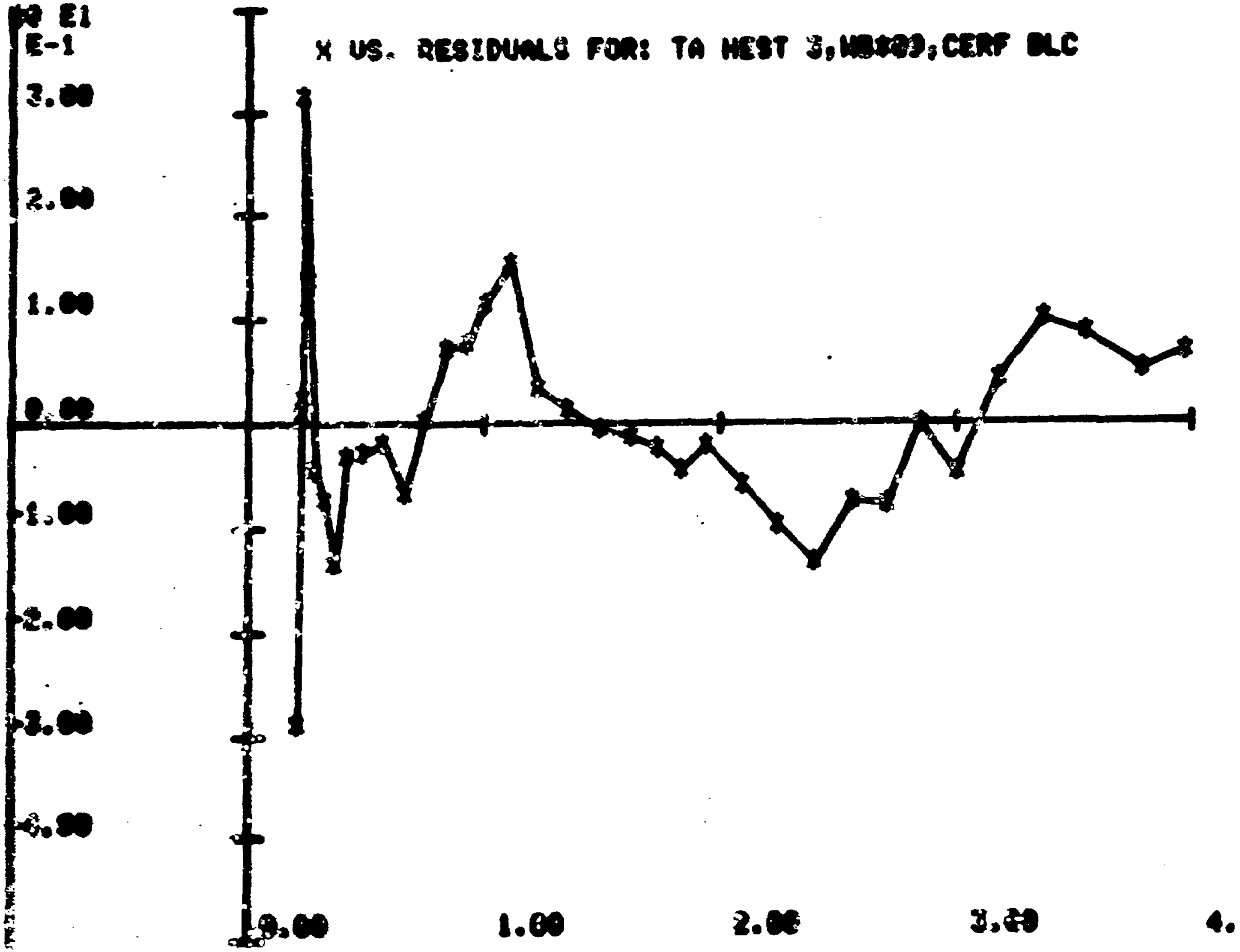
M.N. = 9　E.U. =0.000,6454.000　VSN=
TSKIP=12.650　DIGITS=0.000,631.500　TAPE22
S.R. =100.00 KHZ　8 50 AM, 2 MAY 78.　FILE=44

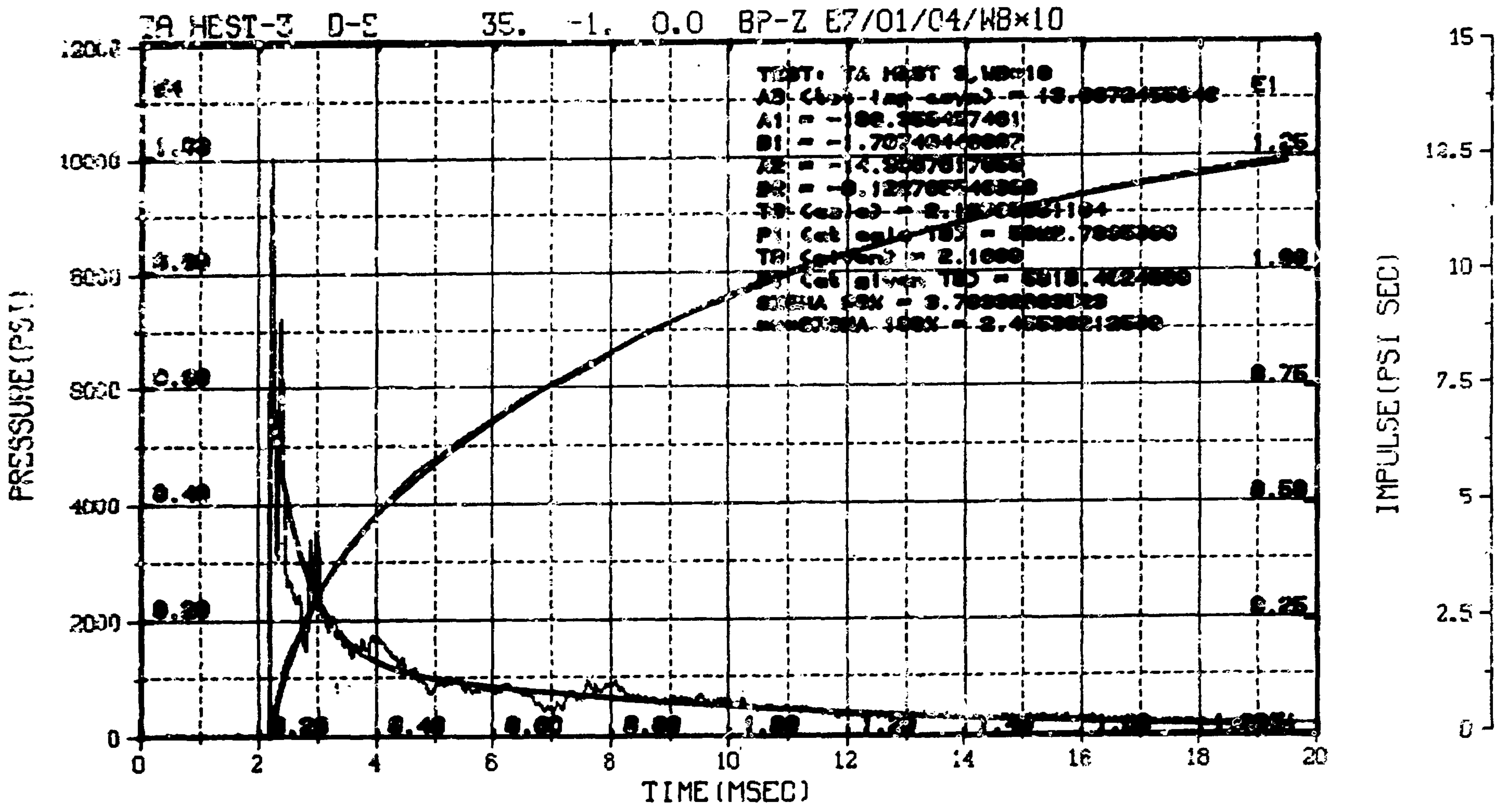
1


X VS. RESIDUALS FOR: TA WEST 3,WBX09
00 E1
E-1
2.00
0.00
-2.00
-4.00
0.00
1.00
2.00
3.00
4.



```
M.N. =     9          E.U.  =0.000,6454.000      VSN=
TSKIP=12.650          DIGITS=0.000,831.500       TAPE22
S.R. =100.00 KHZ        8 50 AM, 2 MAY 78.       FILE=44
```


X VS. RESIDUALS FOR: TA WEST 3,WB103,CERF BLC
E1
E-1
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
0.00
1.00
2.00
3.00
4.

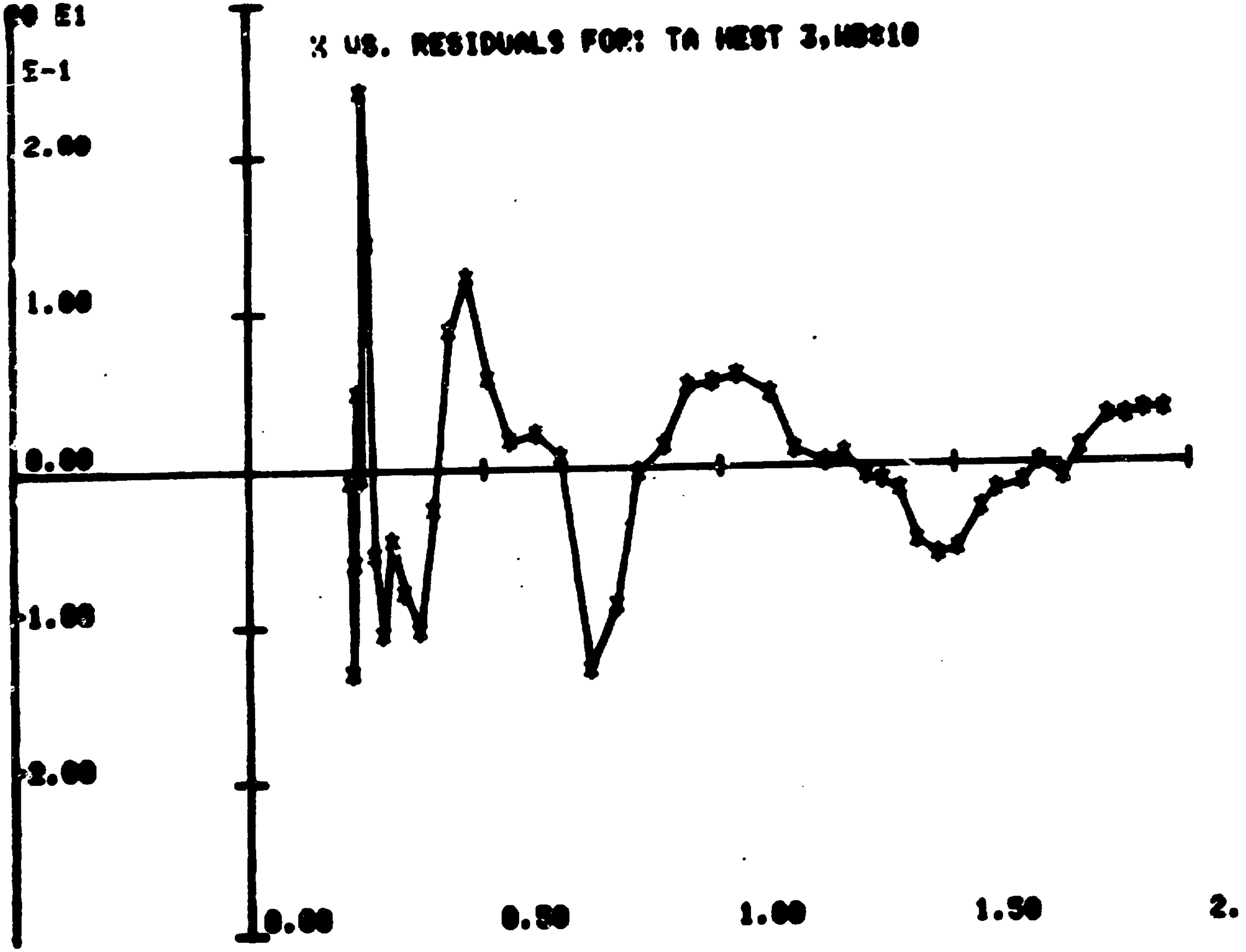


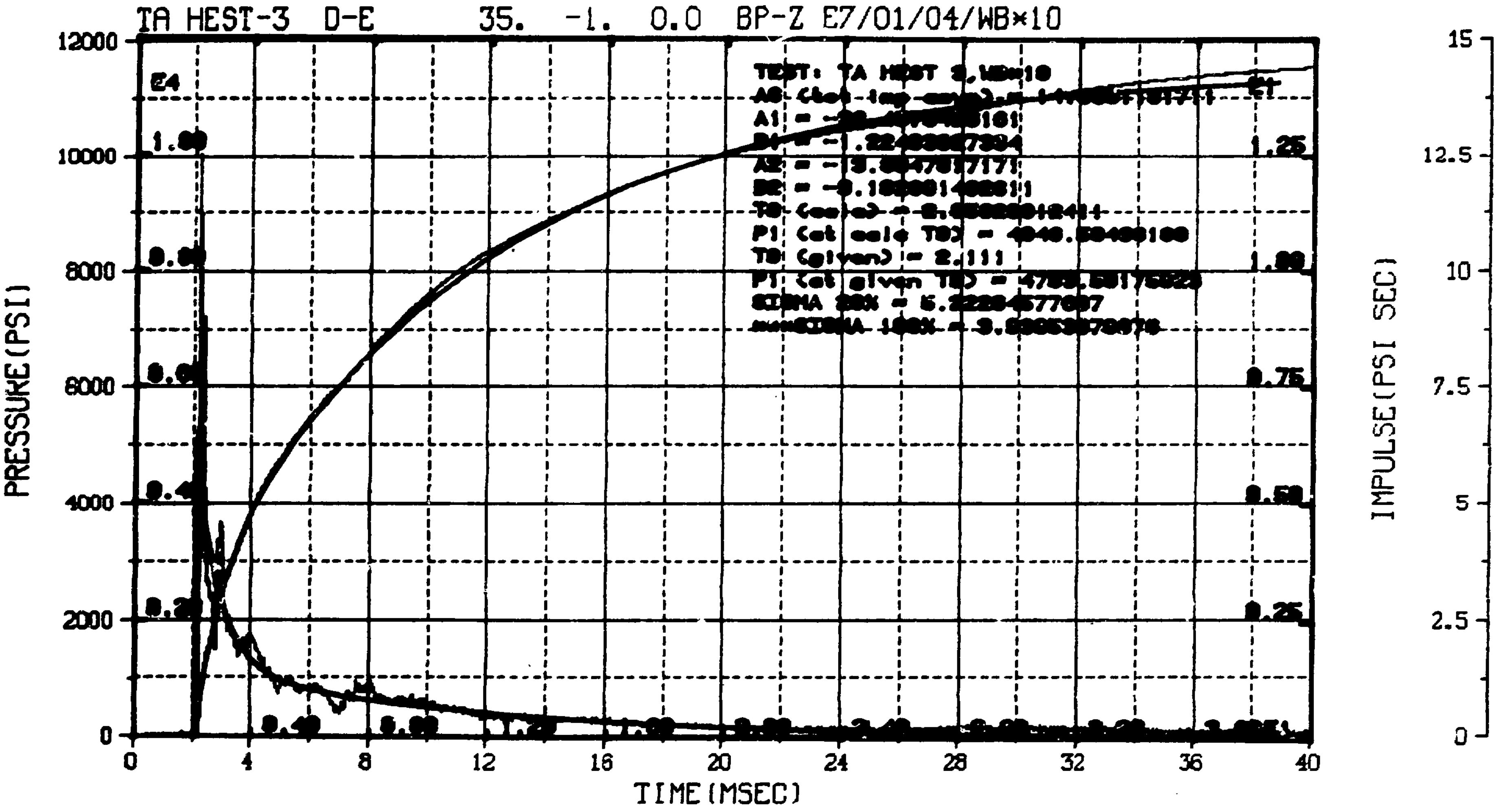
M.N. = 10
TSKIP=12.640
S.R. =100.00 KHZ

E.U. =0.000,6272.000
DIGITS=0.000,834.000
8 50 AM, 2 MAY 78.

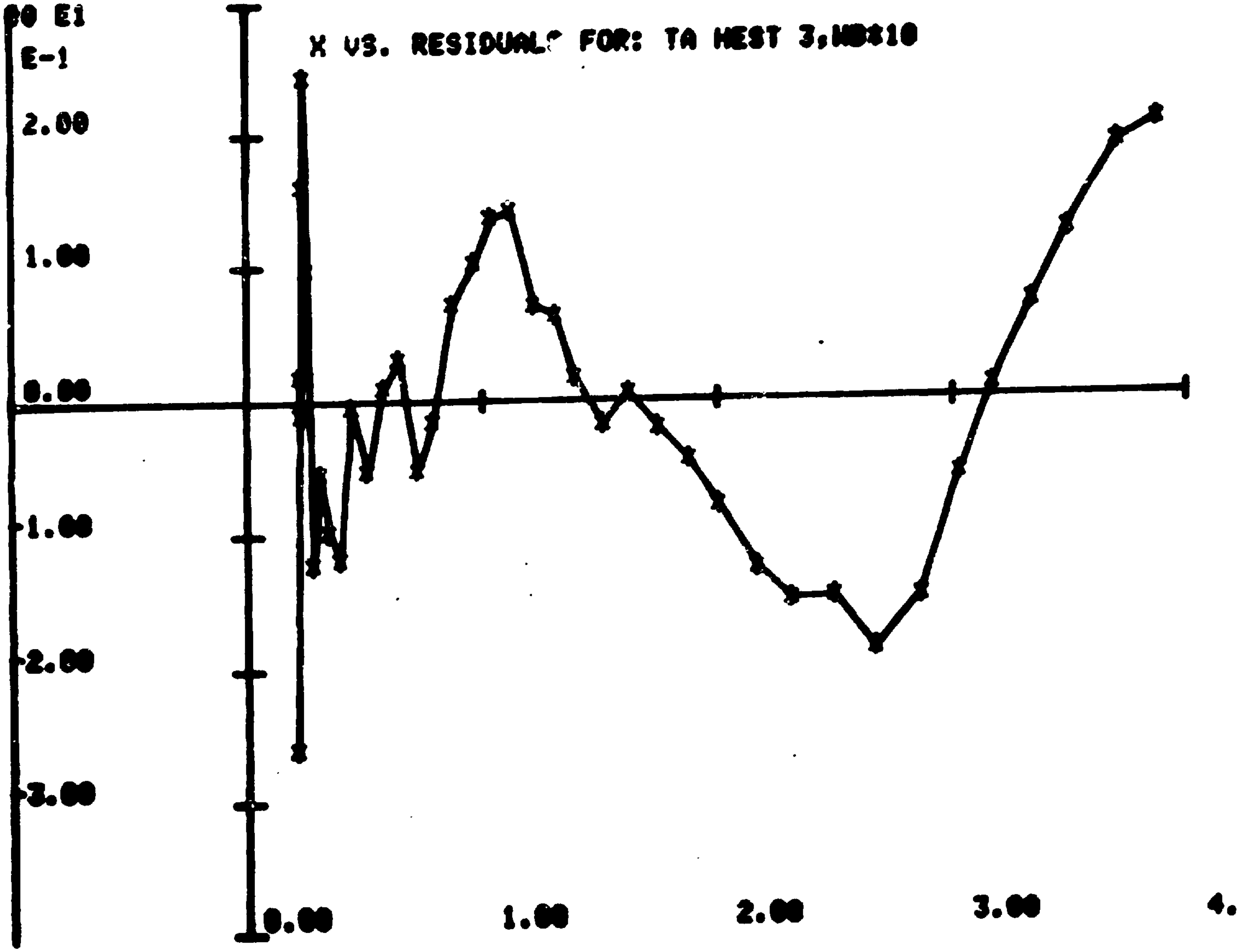
VSN=
TAPE22
FILE=8

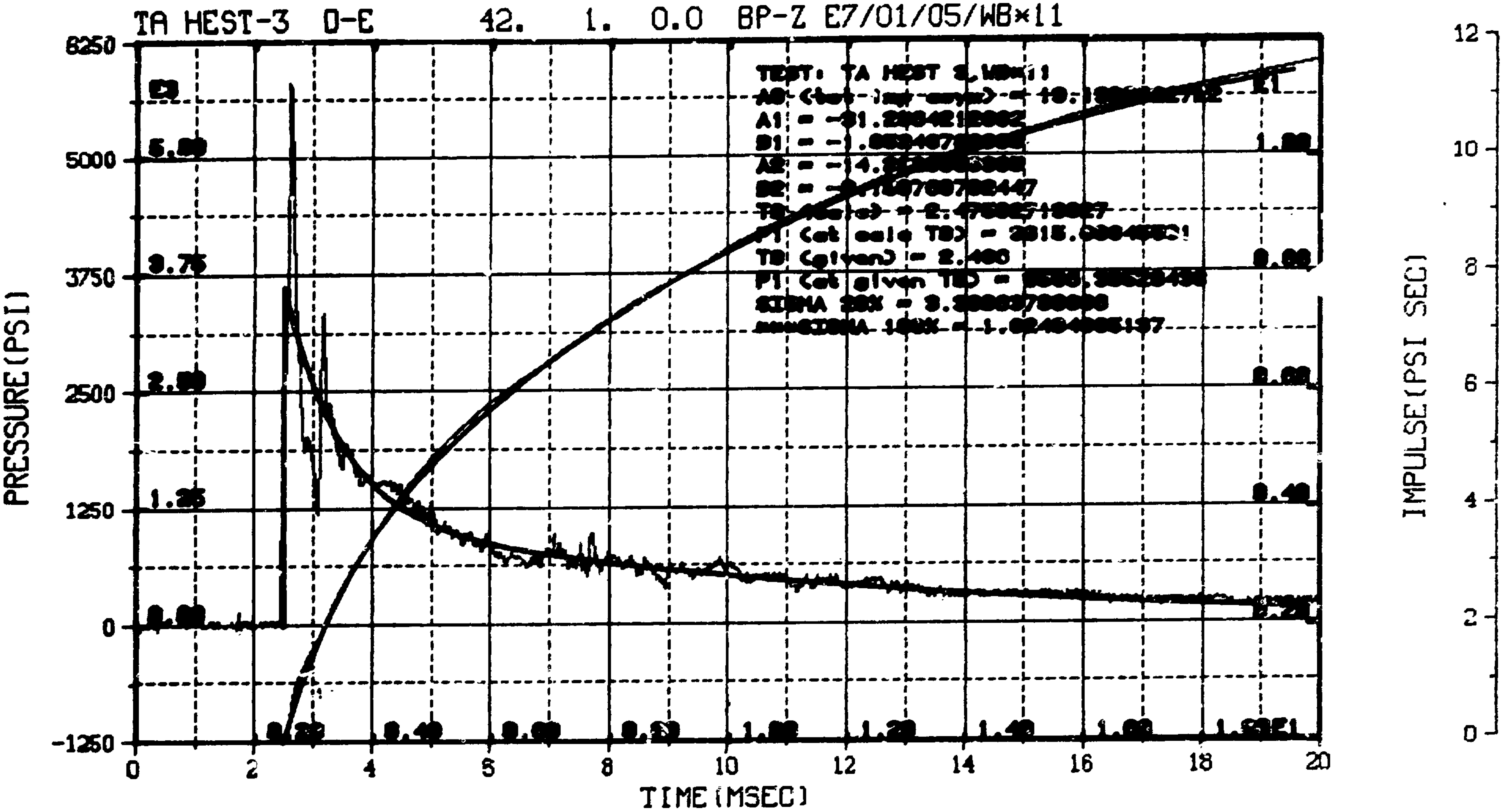
1


% VS. RESIDUALS FOR: TA WEST 3,WD610
00 E1
E-1
2.00
1.00
0.00
-1.00
-2.00
0.00
0.50
1.00
1.50
2.



```
M.N. =    10          E.U.  -0.000,6272.000        VSN=
TSKIP=12.640          DIGITS=0.000,834.000         TAPE22
S.R. =100.00 KHZ        8 50 AM, 2 MAY 78.         FILE=8
                                                          1
```


X VS. RESIDUALS FOR: TA WEST 3,WB=10
00 E1
E-1
2.00
1.00
0.00
-1.00
-2.00
-3.00
0.00
1.00
2.00
3.00
4.

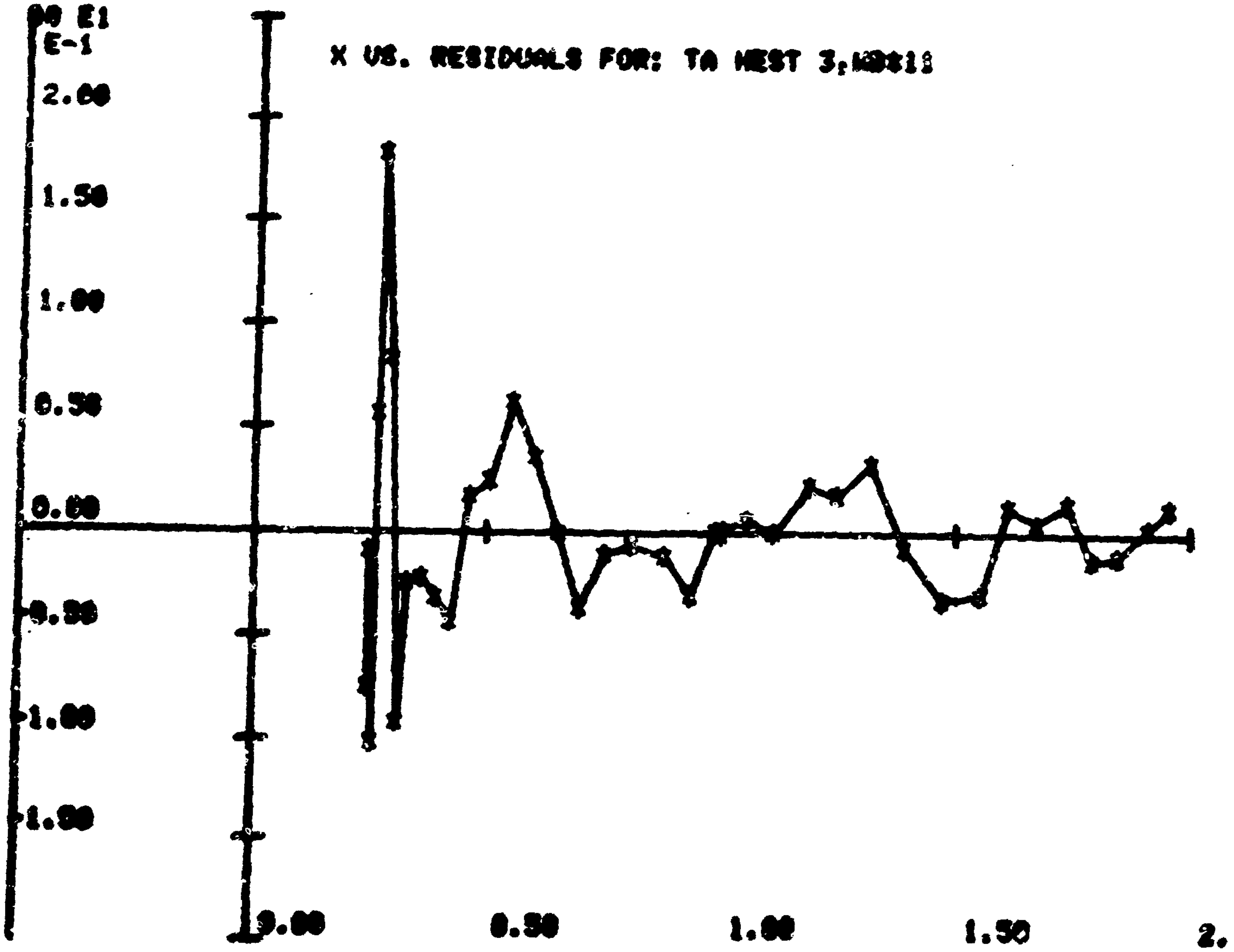


M.N. = 11
TSKIP=12.640
S.R. =100.00 KHZ

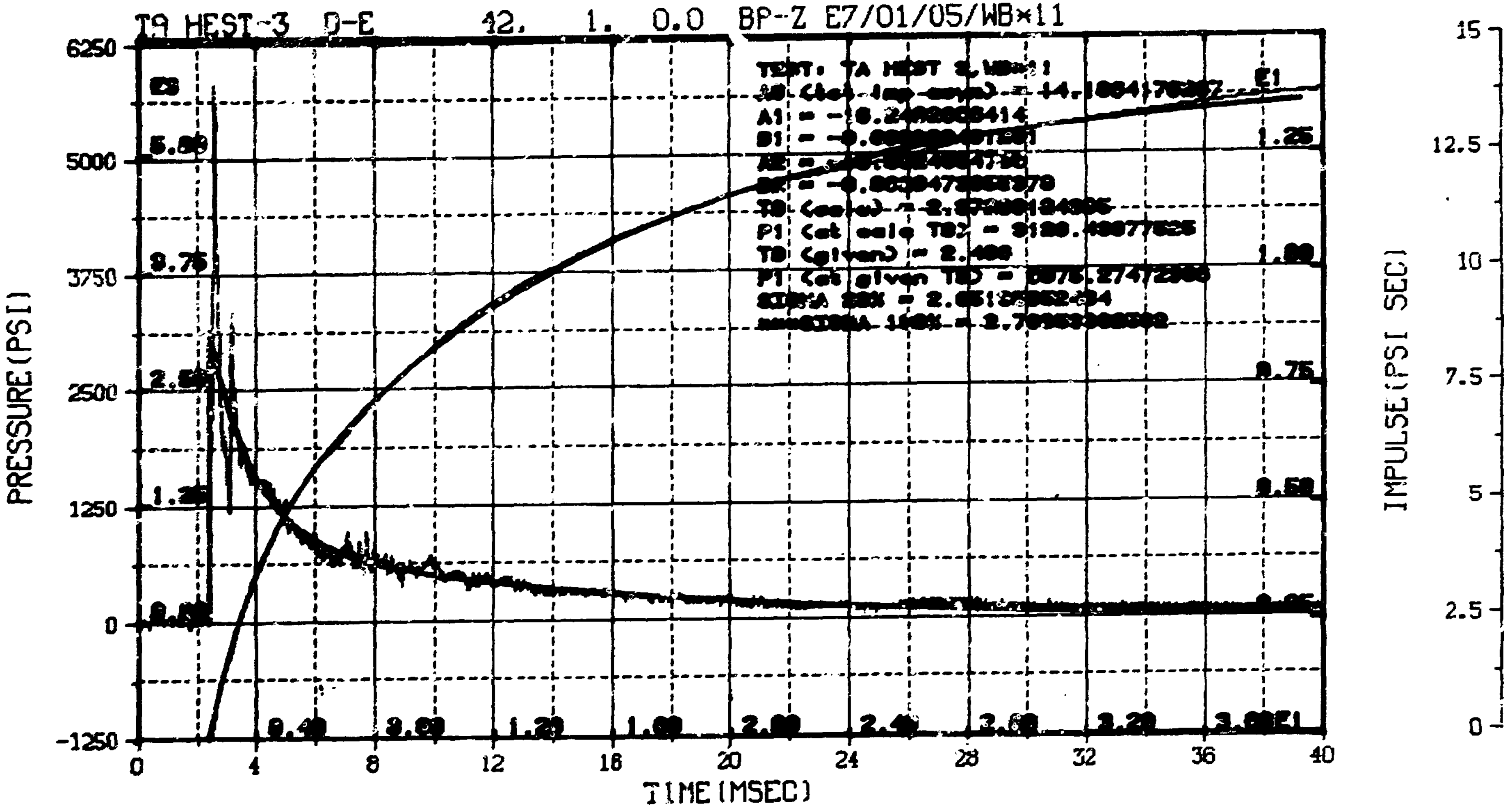
E.U. =0.000,4222.000
DIGITS=0.000,602.500
8 50 AM, 2 MAY 78.

VSN=
TAPE22
FILE=10

1



X VS. RESIDUALS FOR: TA WEST 3,[illegible]

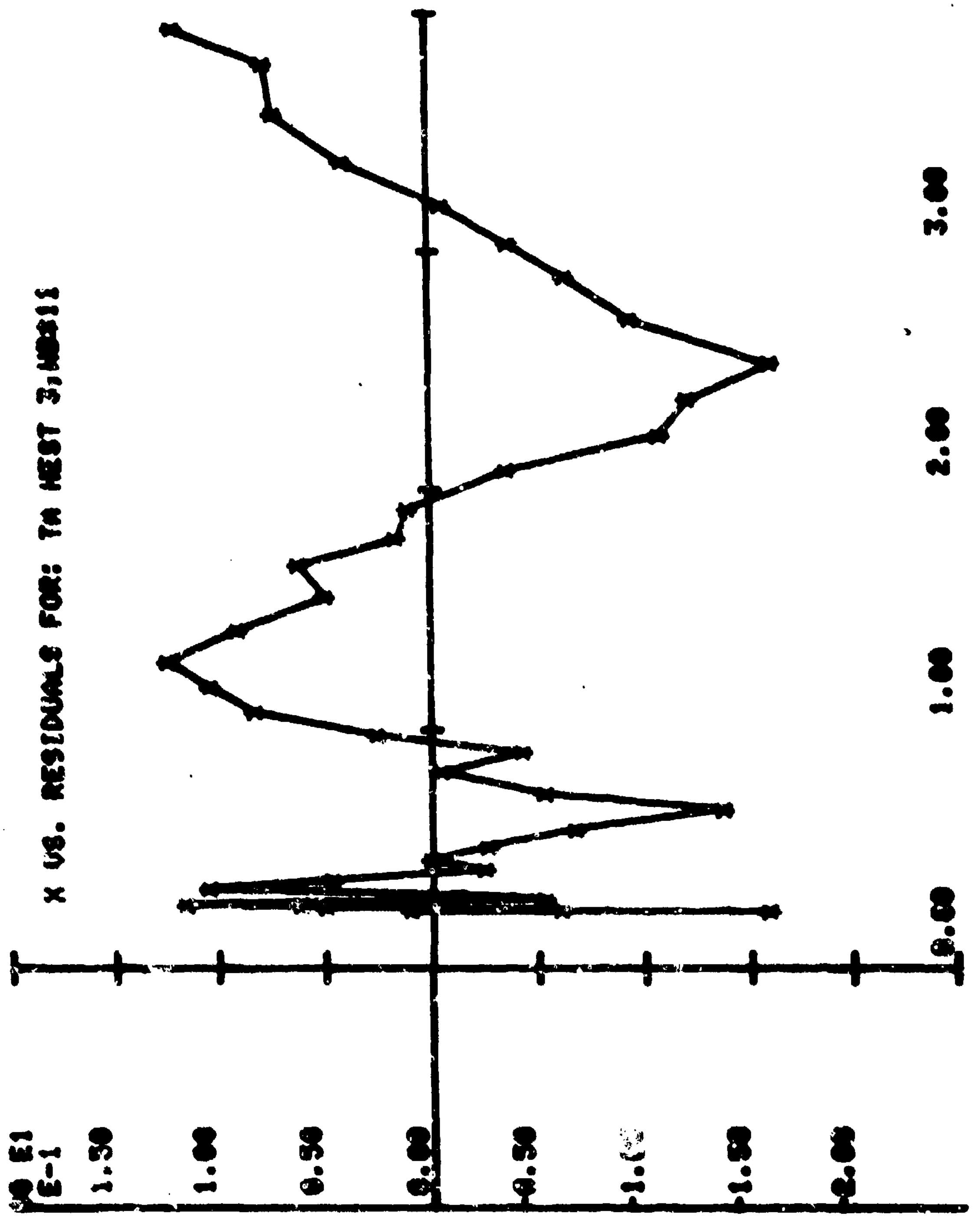


M.N. = 11
TSKIP=12.640
S.R. =100.00 KHZ

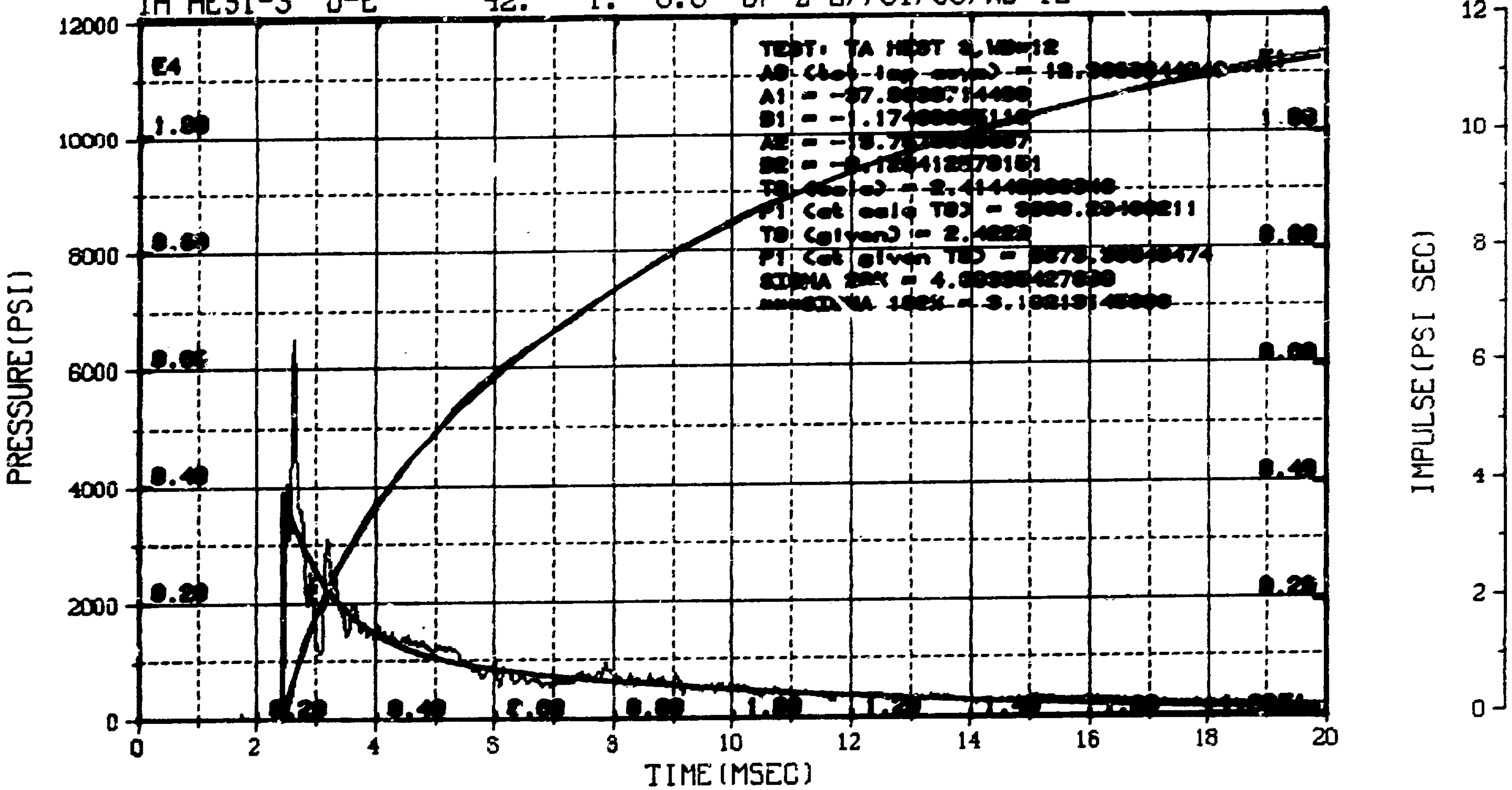
E.U. =0.000,4222.000
DIGITS=0.000,602.500
8 50 AM, 2 MAY 78.

VSN=
TAPE22
FILE=10

1


X VS. RESIDUALS FOR: TN WEST 3,NEX11
0 E1
E-1
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
0.00
1.00
2.00
3.00
4.

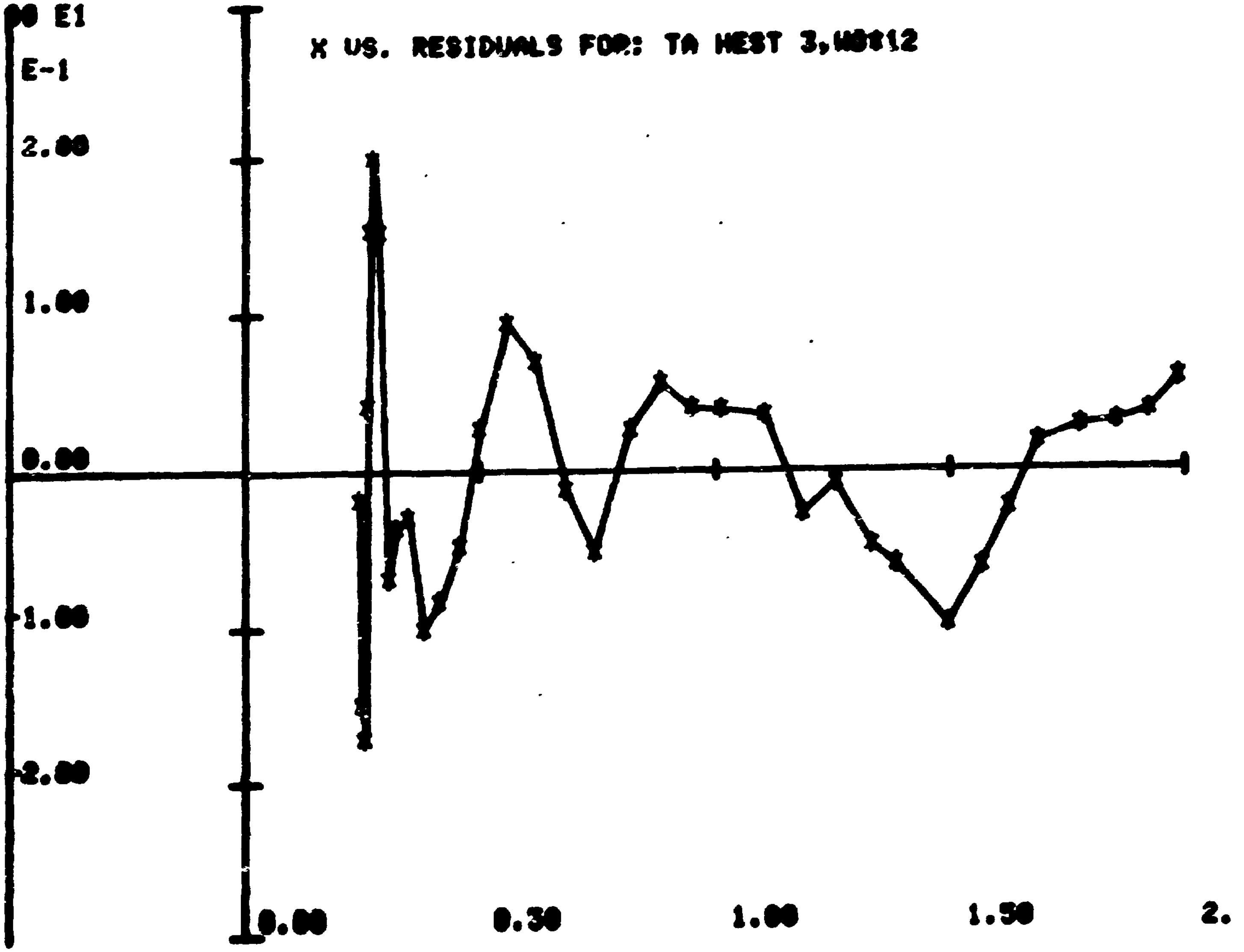
TA HEST-3 D-E 42. -1. 0.0 BP-Z E7/01/06/WB×12

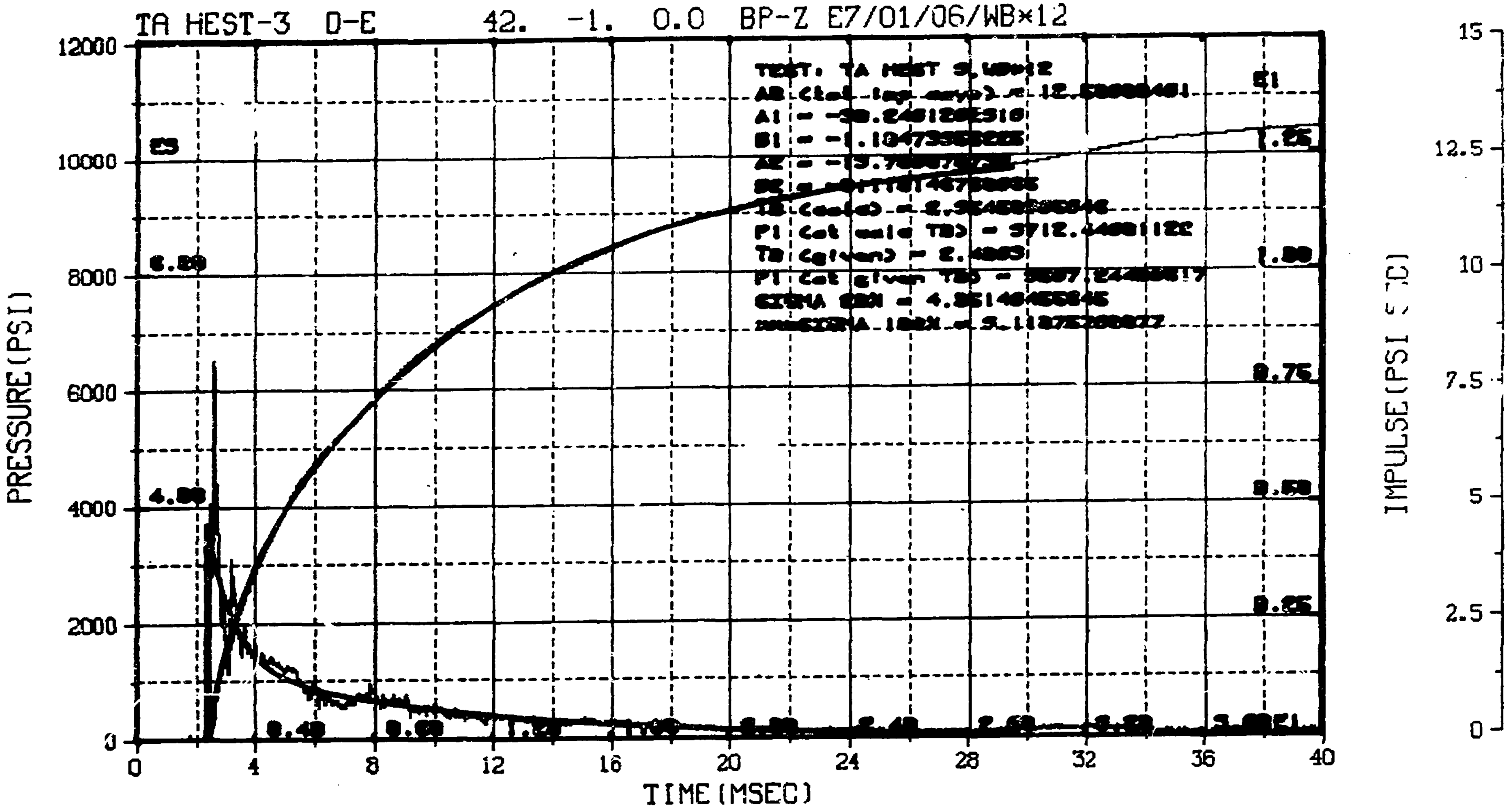


M.N. = 12
TSKIP=12.640
S.R. =100.00 KHZ

E.U. =0.000,6372.000
DIGITS=0.000,919.125
8 50 AM, 2 MAY 78.

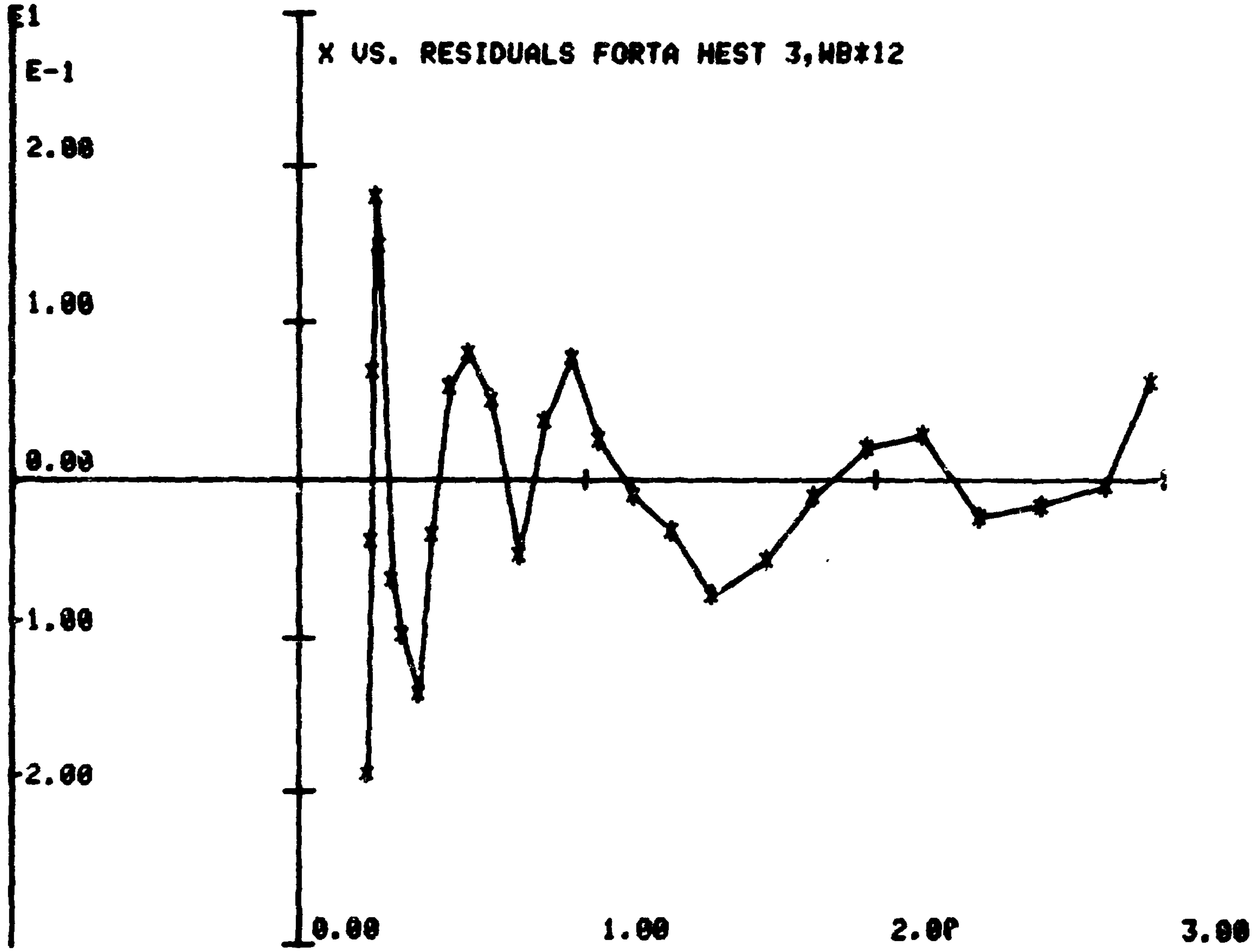
VSN=
TAPE22
FILE=12 . 1

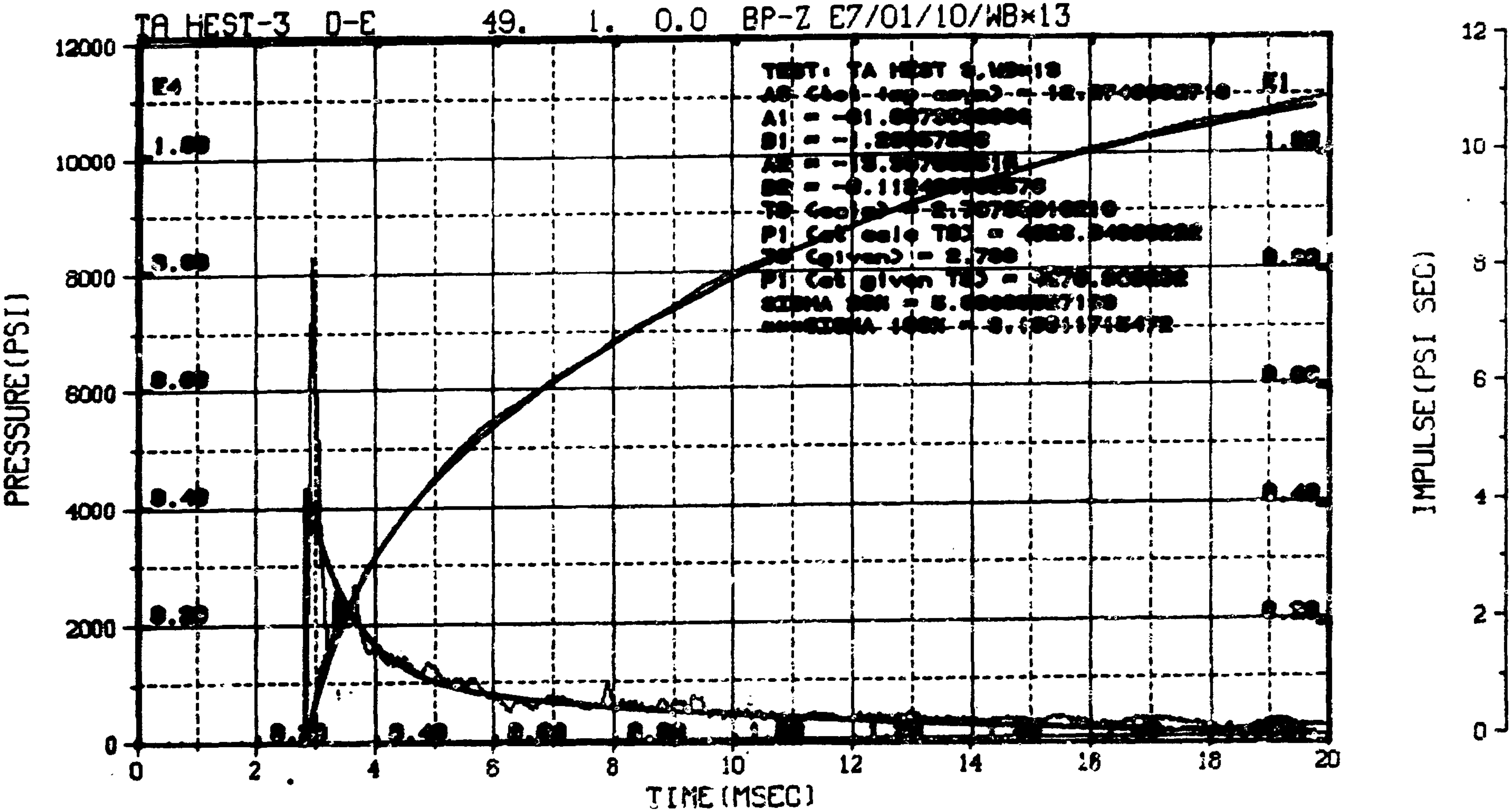

X VS. RESIDUALS FOR: TA WEST 3,WS#12
00 E1
E-1
2.00
1.00
0.00
-1.00
-2.00
0.00
0.50
1.00
1.50
2.



```
M.N. =    12         E.U.   =0.000,6372.000      VSN=
TSKIP=12.640         DIGITS=0.000,919.125        TAPE22
S.R. =100.00 KHZ       8 50 AM, 2 MAY 78.        FILE=12
```

1


X VS. RESIDUALS FORTA HEST 3,WB*12
E1
E-1
2.00
1.00
0.00
-1.00
-2.00
0.00
1.00
2.0P
3.00

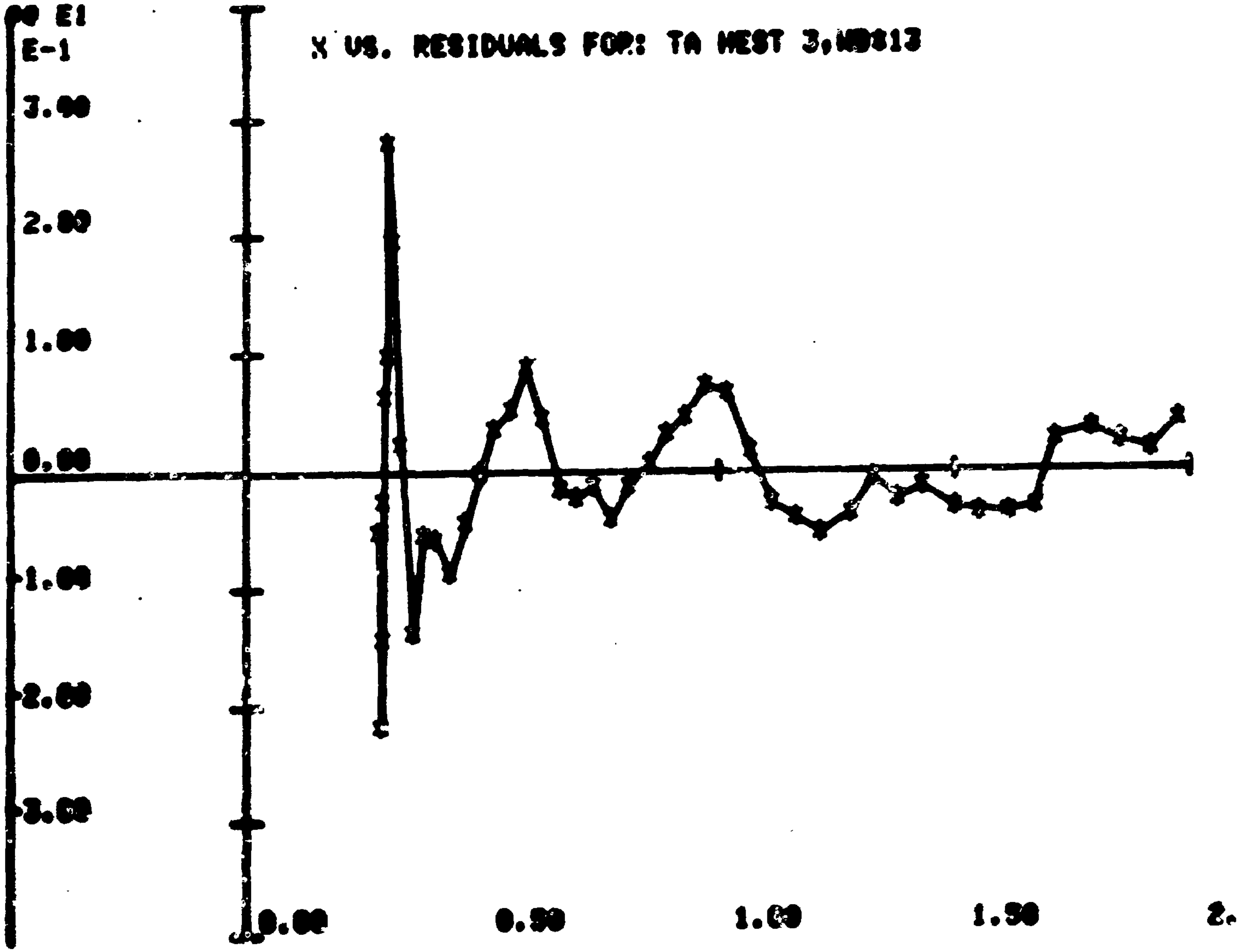


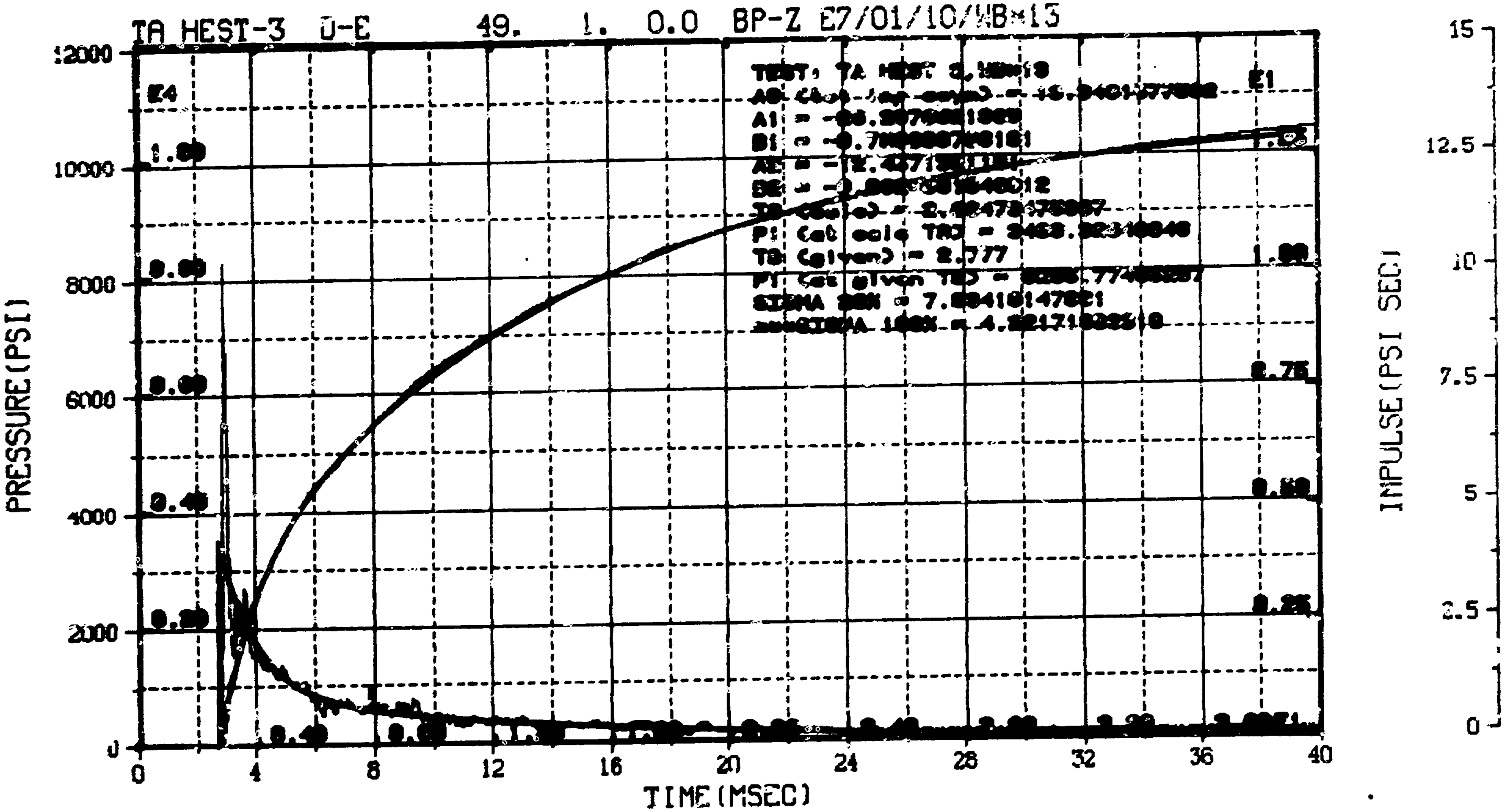
M.N. = 13
TSKIP=12.640
S.R. =100.00 KHZ

E.U. =0.000,6602.000
DIGITS=0.000,970.000
8 50 AM, 2 MAY 78.

VSN=
TAPE22
FILE=14

1

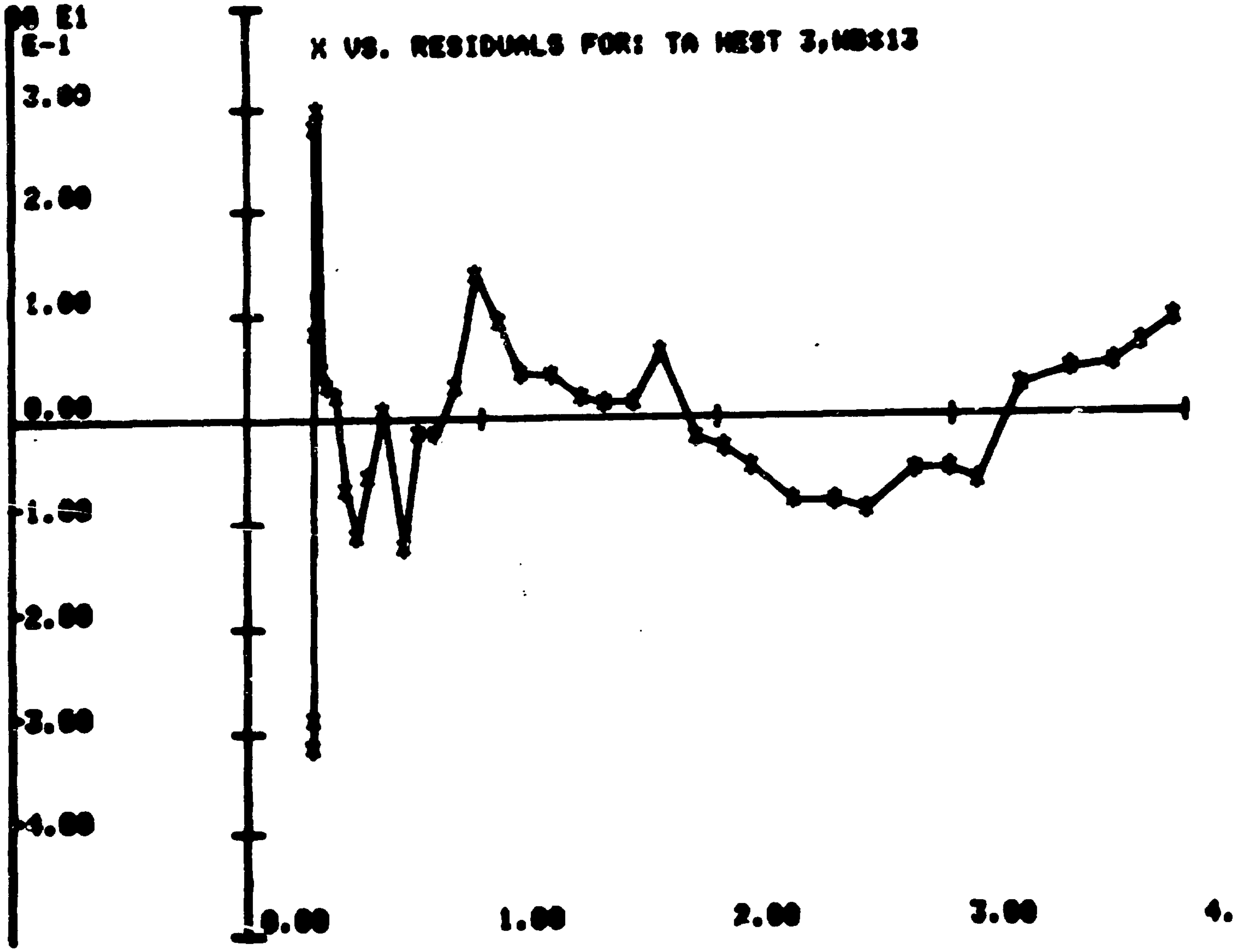

X VS. RESIDUALS FOR: TA WEST 3,WD813
00 E1
E-1
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
0.00
0.50
1.00
1.50
2.

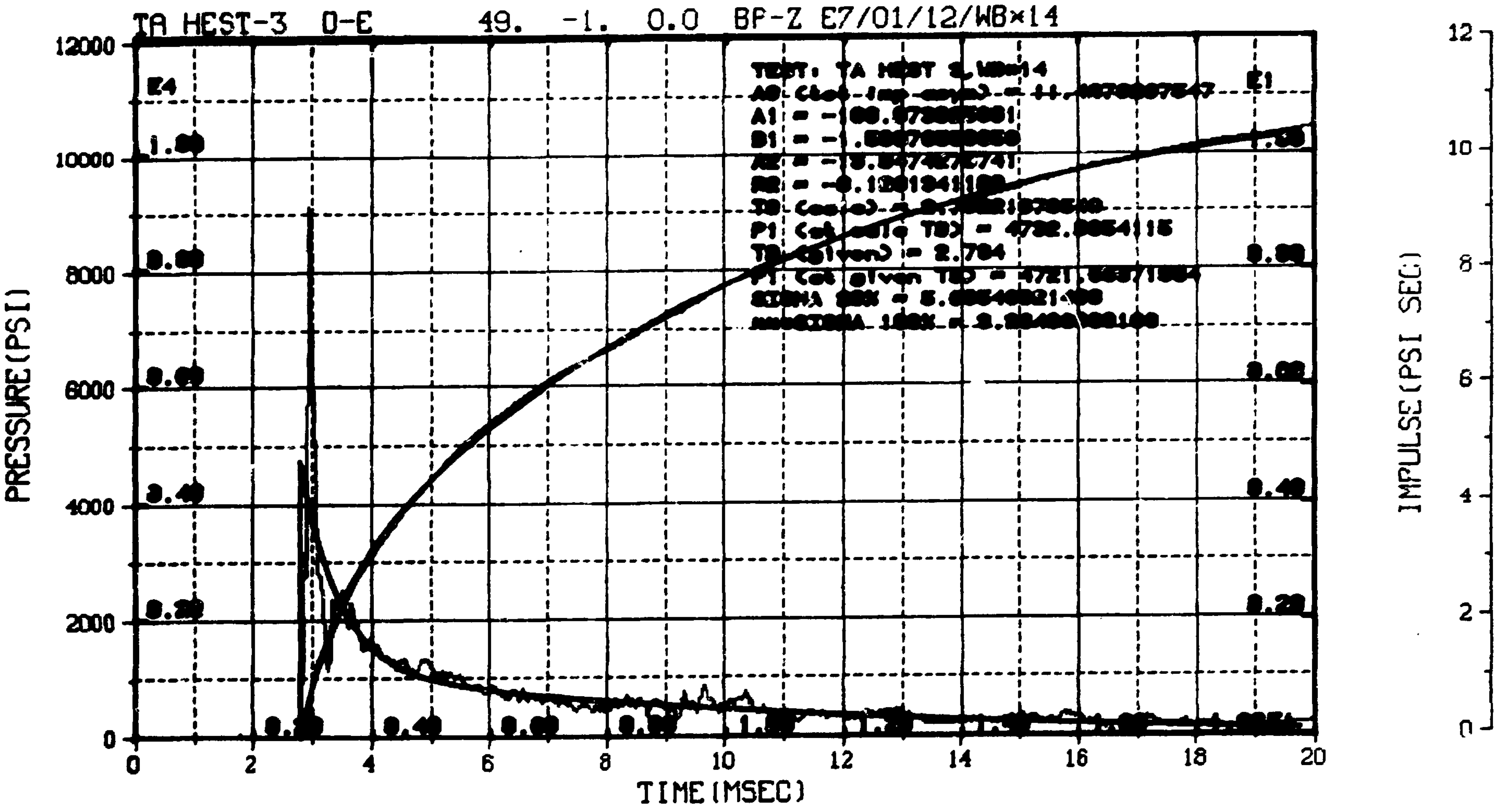


M.N. = 13
TSKIP=12.640
S.R. =100.00 KHZ

E.U. =0.000,6602.000
DIGITS=0.000,970.000
8 50 AM, 2 MAY 78.

VSN=
TAPE22
FILE=14
1


X VS. RESIDUALS FOR: TA WEST 3,WB$13
00 E1
E-1
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
0.00
1.00
2.00
3.00
4.

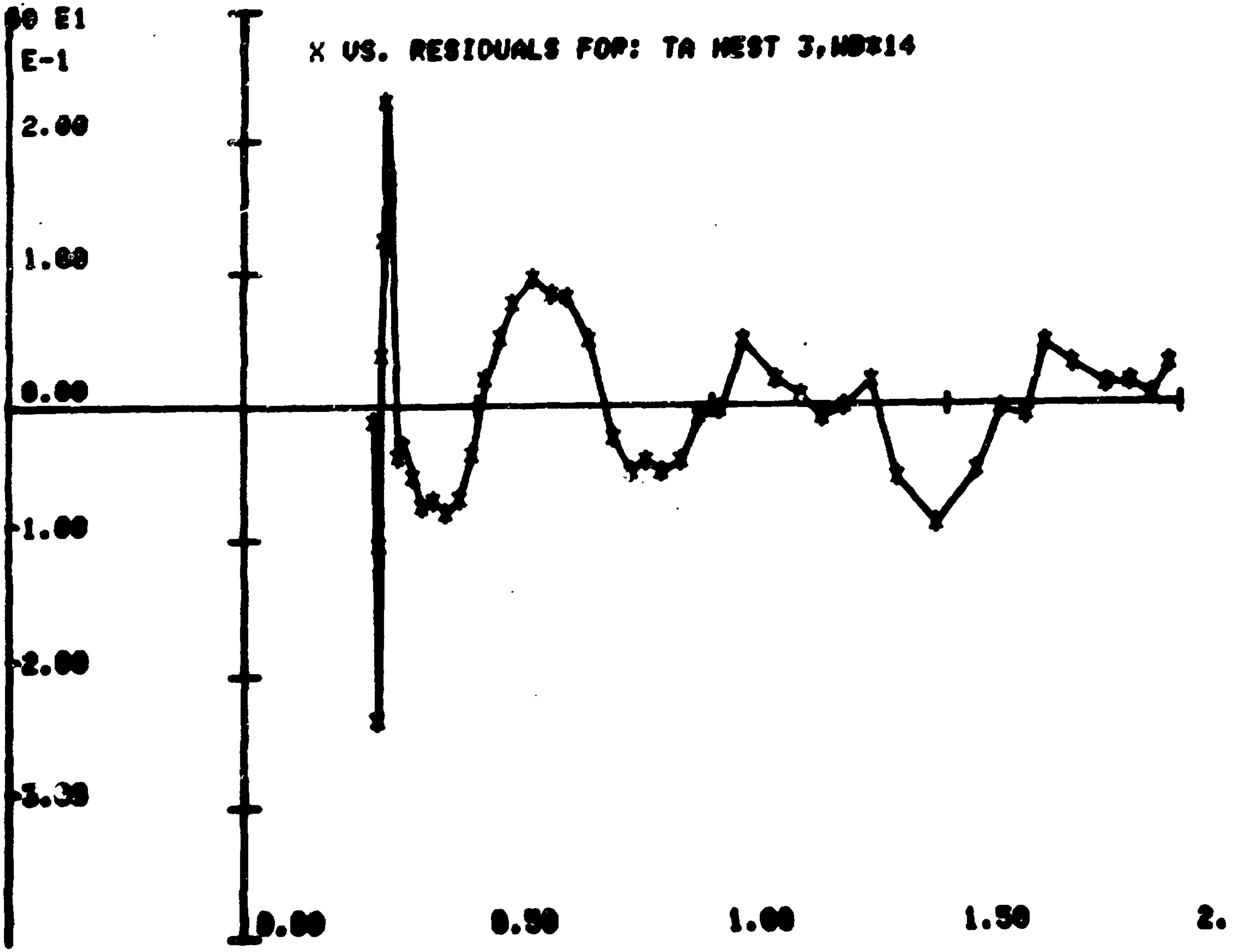


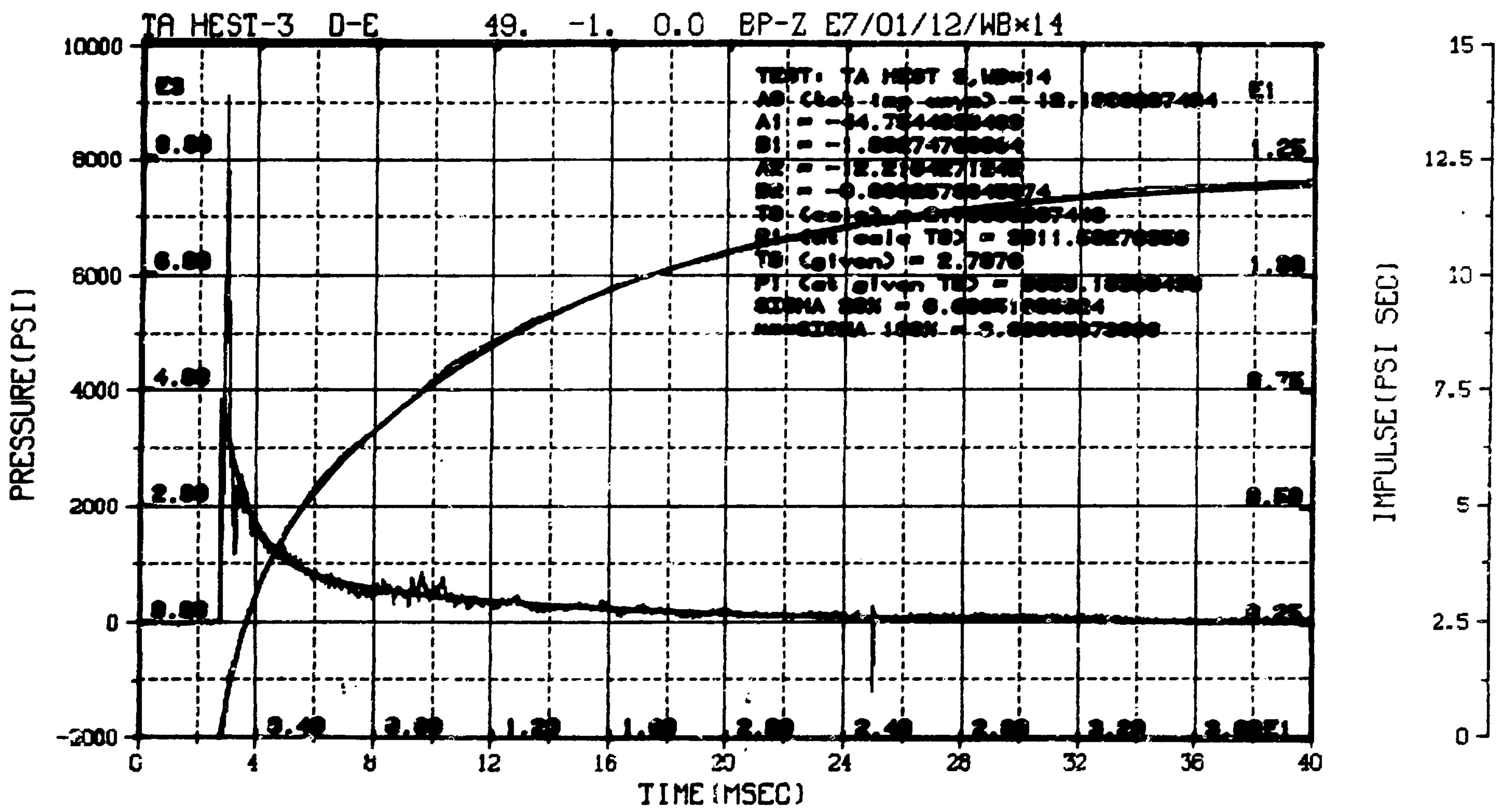
M.N. = 14
TSKIP=12.640
S.R. =100.00 KHZ

E.U. =0.000,6965.000
DIGITS=0.000,1002.000
8 50 AM, 2 MAY 78.

VSN=
TAPE22
FILE=18

1


X VS. RESIDUALS FOR: TA WEST 3,WD*14
.0 E1
E-1
2.00
1.00
0.00
-1.00
-2.00
-3.30
0.00
0.50
1.00
1.50
2.

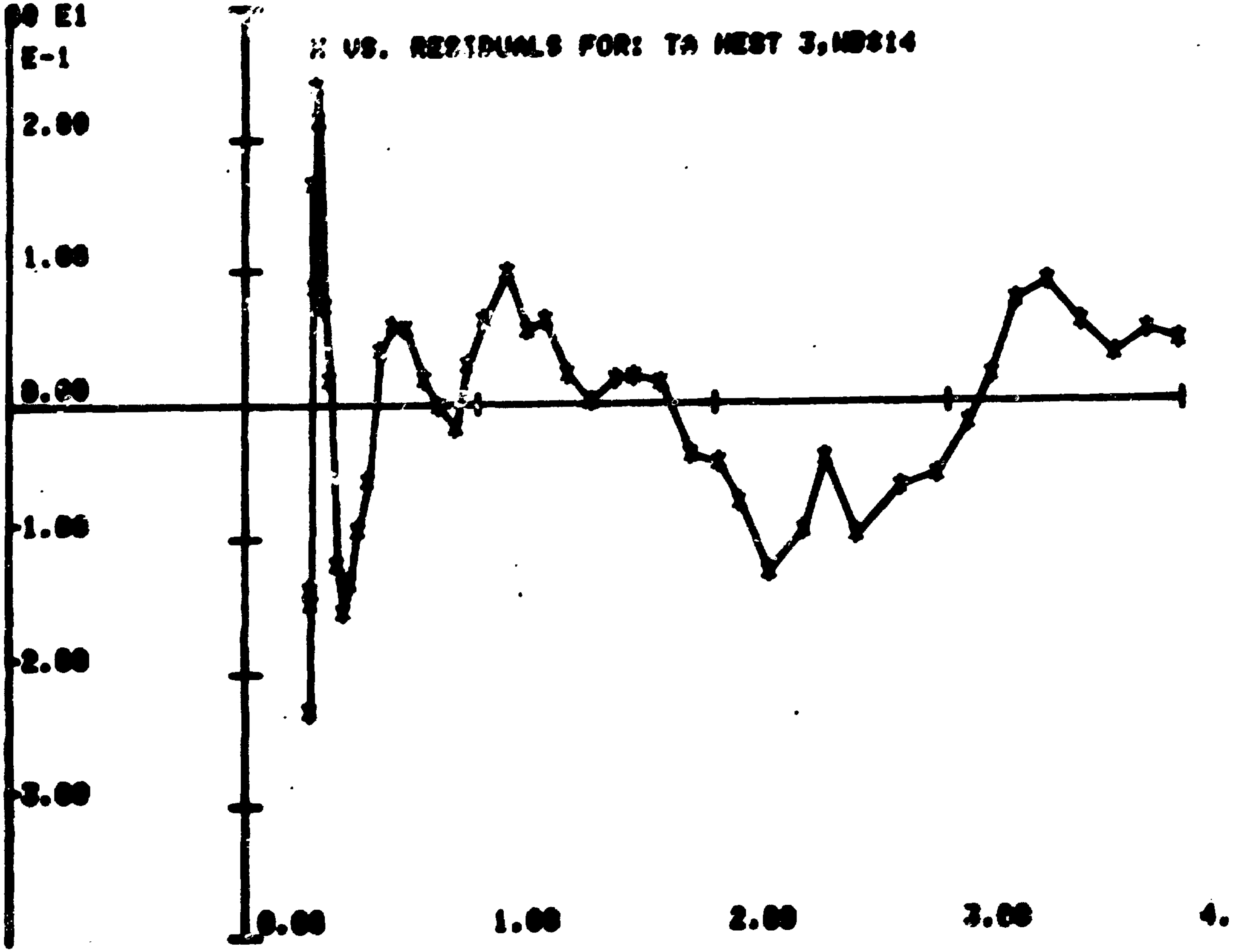


M.N. = 14
TSKIP=12.640
S.R. =100.00 KHZ

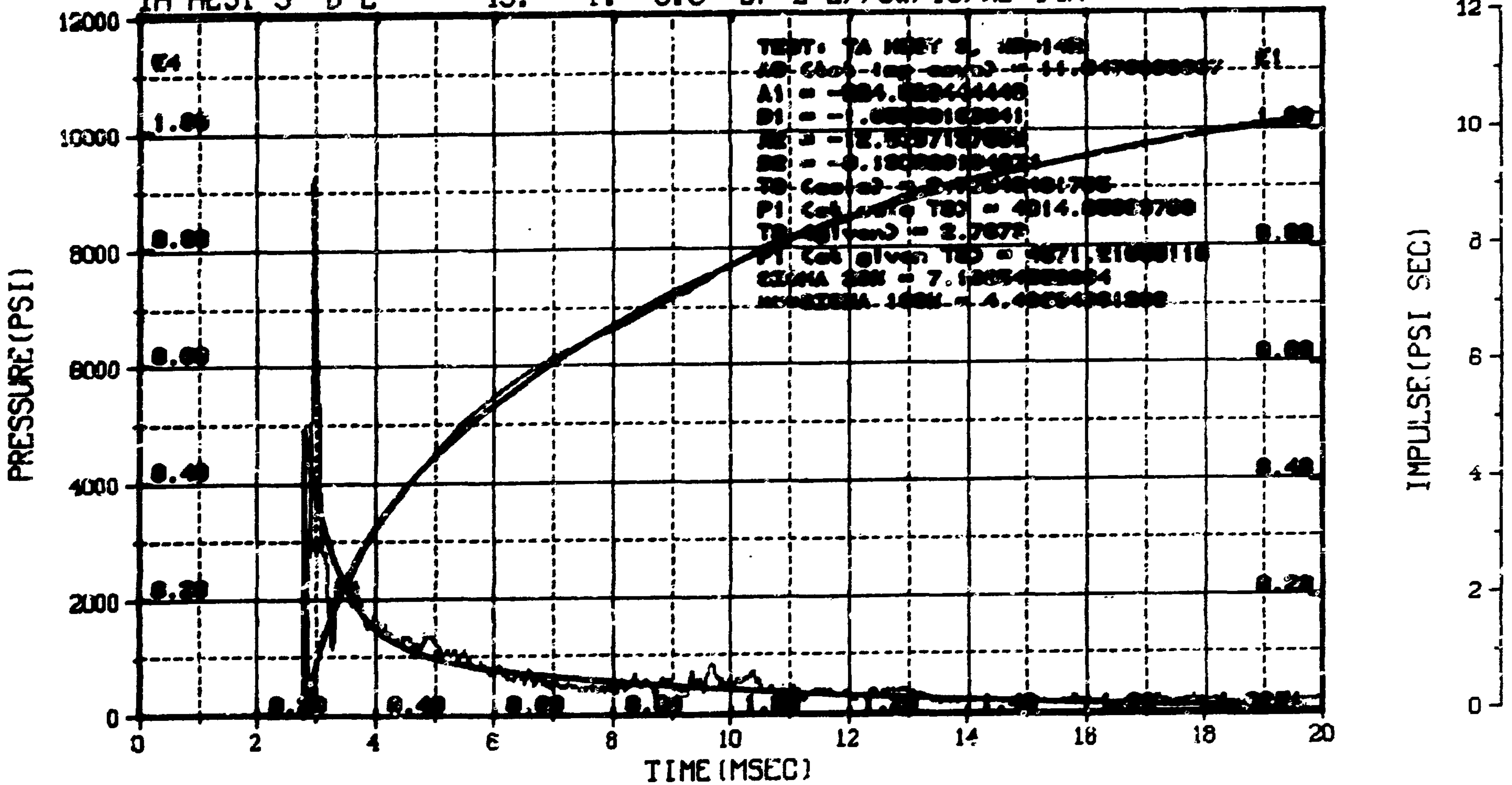
E.U. =0.000,6965.000
DIGITS=0.000,1002.000
8 50 AM, 2 MAY 78.

VSN=
TAPE22
FILE=18

1


X VS. RESIDUALS FOR: TA WEST 3,MDS14
00 E1
E-1
2.00
1.00
0.00
-1.00
-2.00
-3.00
0.00
1.00
2.00
3.00
4.

TA HEST-3 D-E 49. -1. 0.0 BP-Z E7/03/13/WB×14R

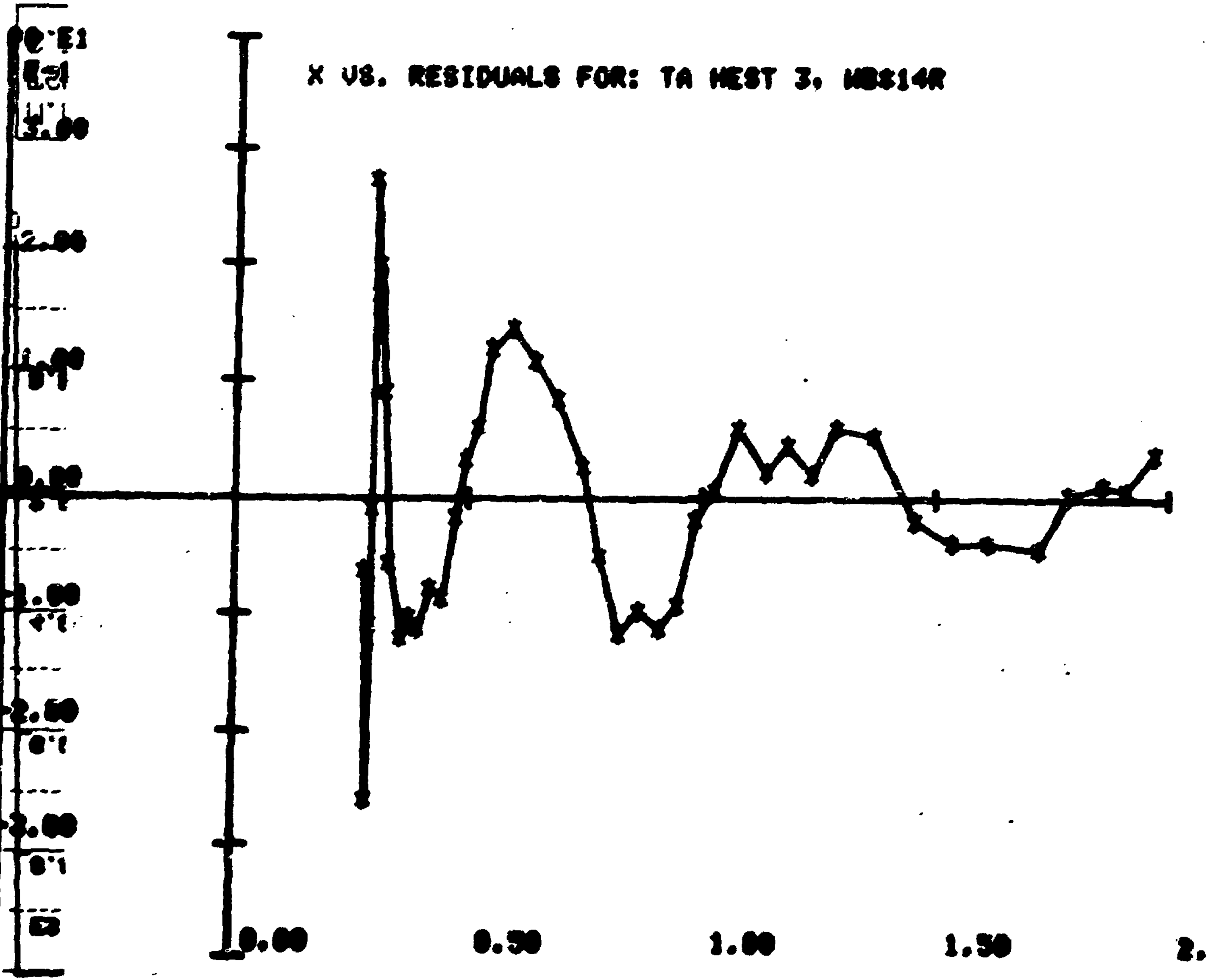


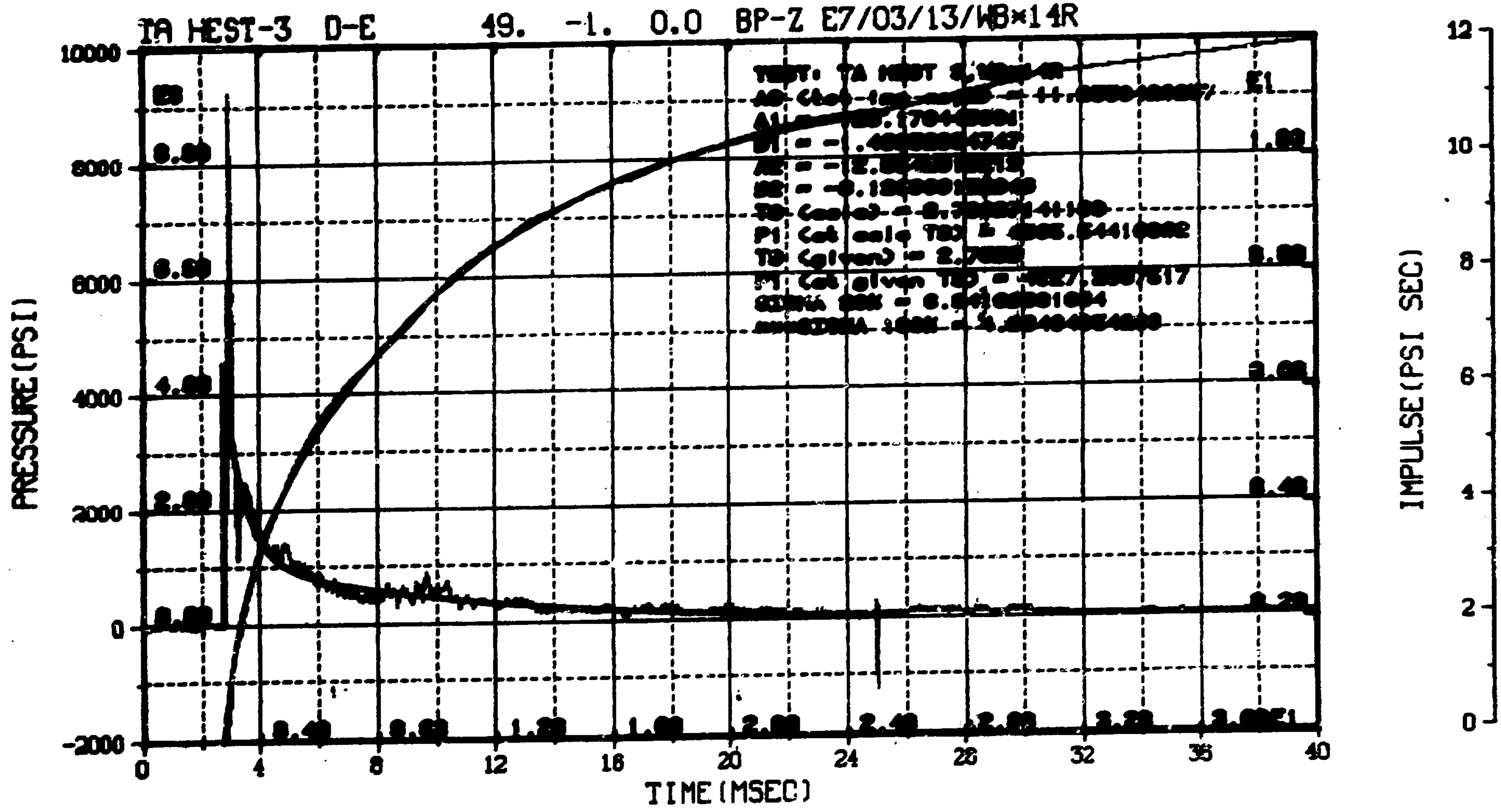
M.N. = 14
TSKIP=12.640
S.R. =100.00 KHZ

E.U. =0.000,6965.000
DIGITS=0.000,614.250
8 50 AM, 2 MAY 78.

VSN=
TAPE22
FILE=28

X VS. RESIDUALS FOR: TA WEST 3, WBS14R



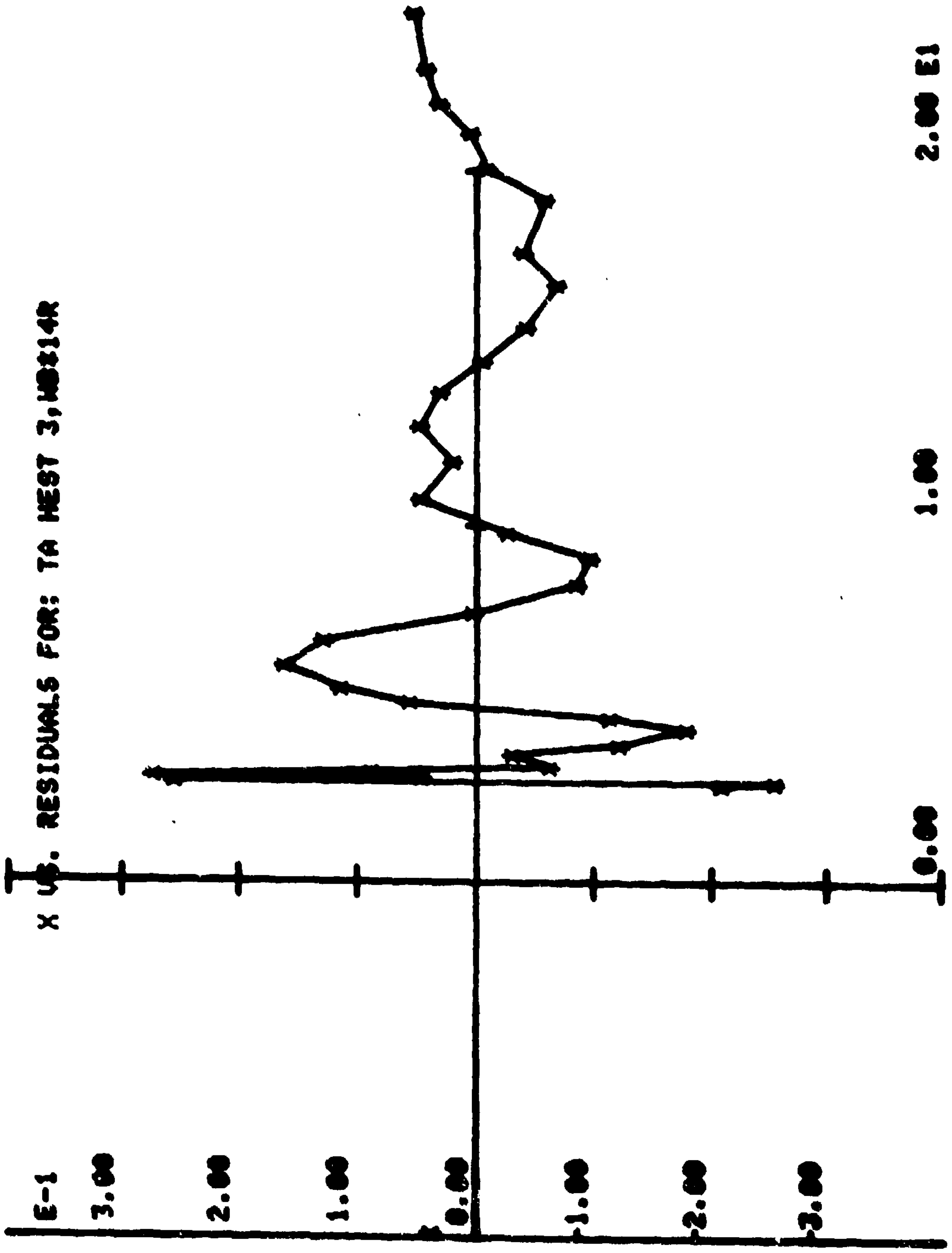


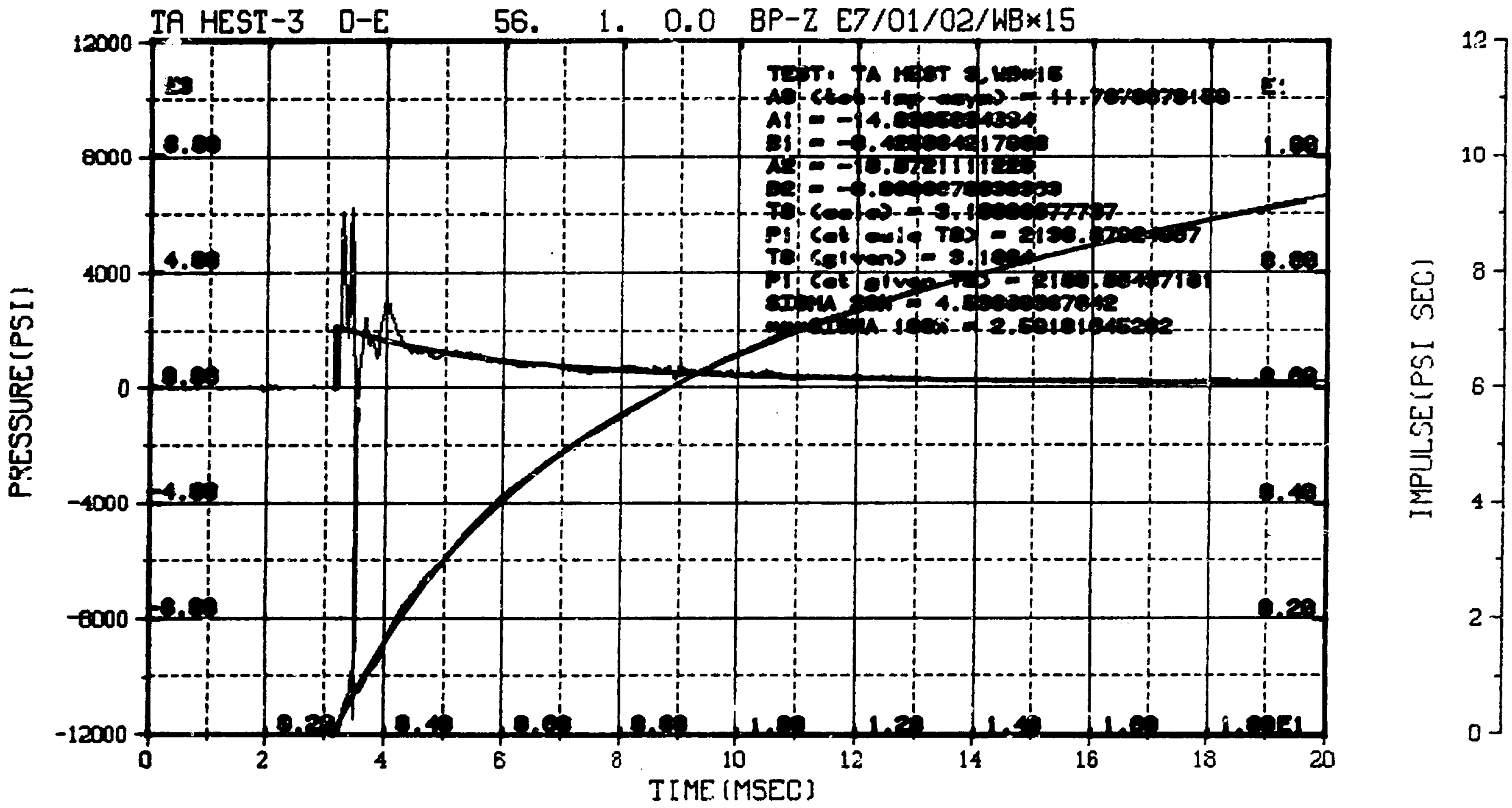
M.N. = 14
TSKIP=12.640
S.R. =100.00 KHZ

E.U. =0.000,6965.000
DIGITS=0.000,614.250
8 50 AM, 2 MAY 78.

VSN=
TAPE22
FILE=28

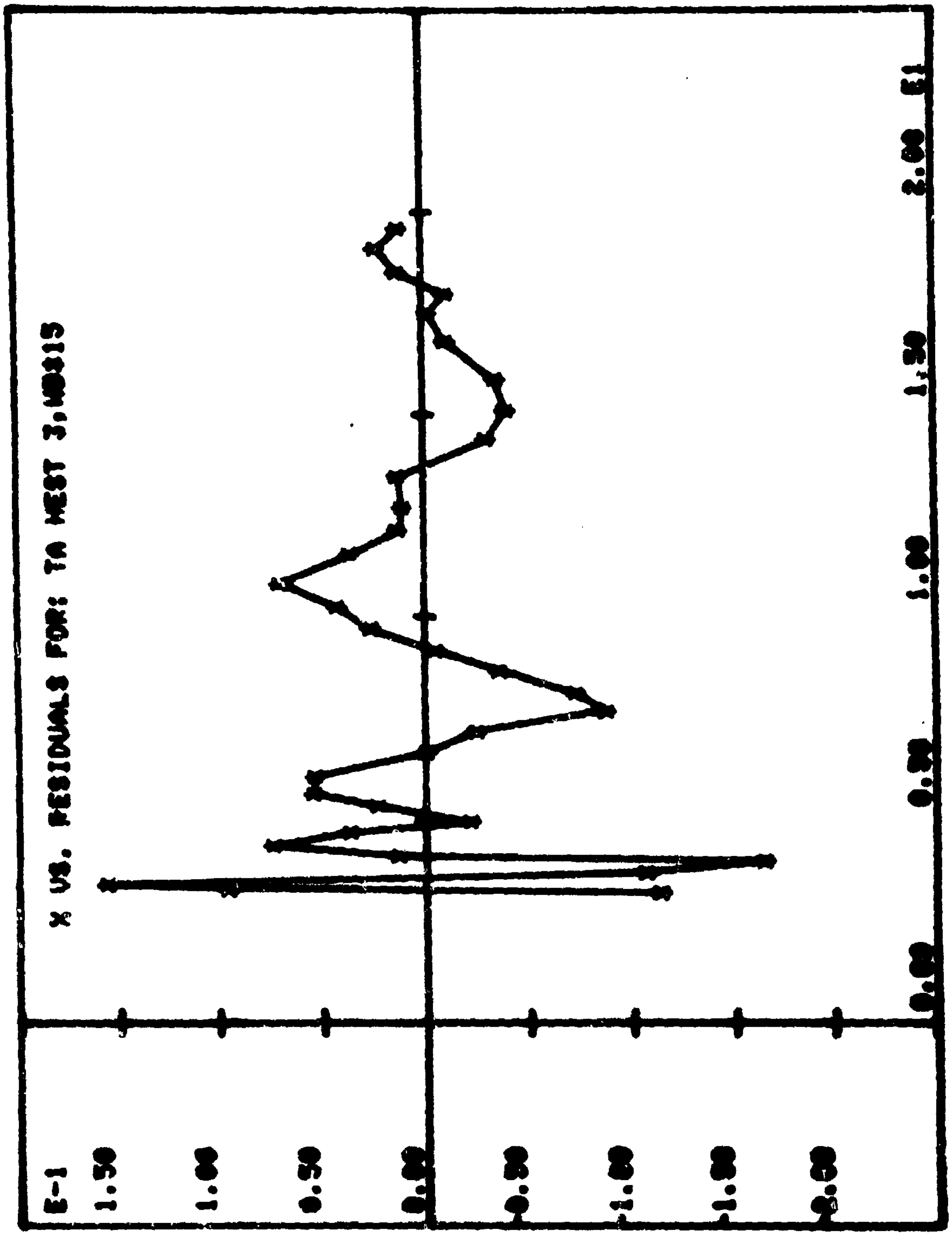
1

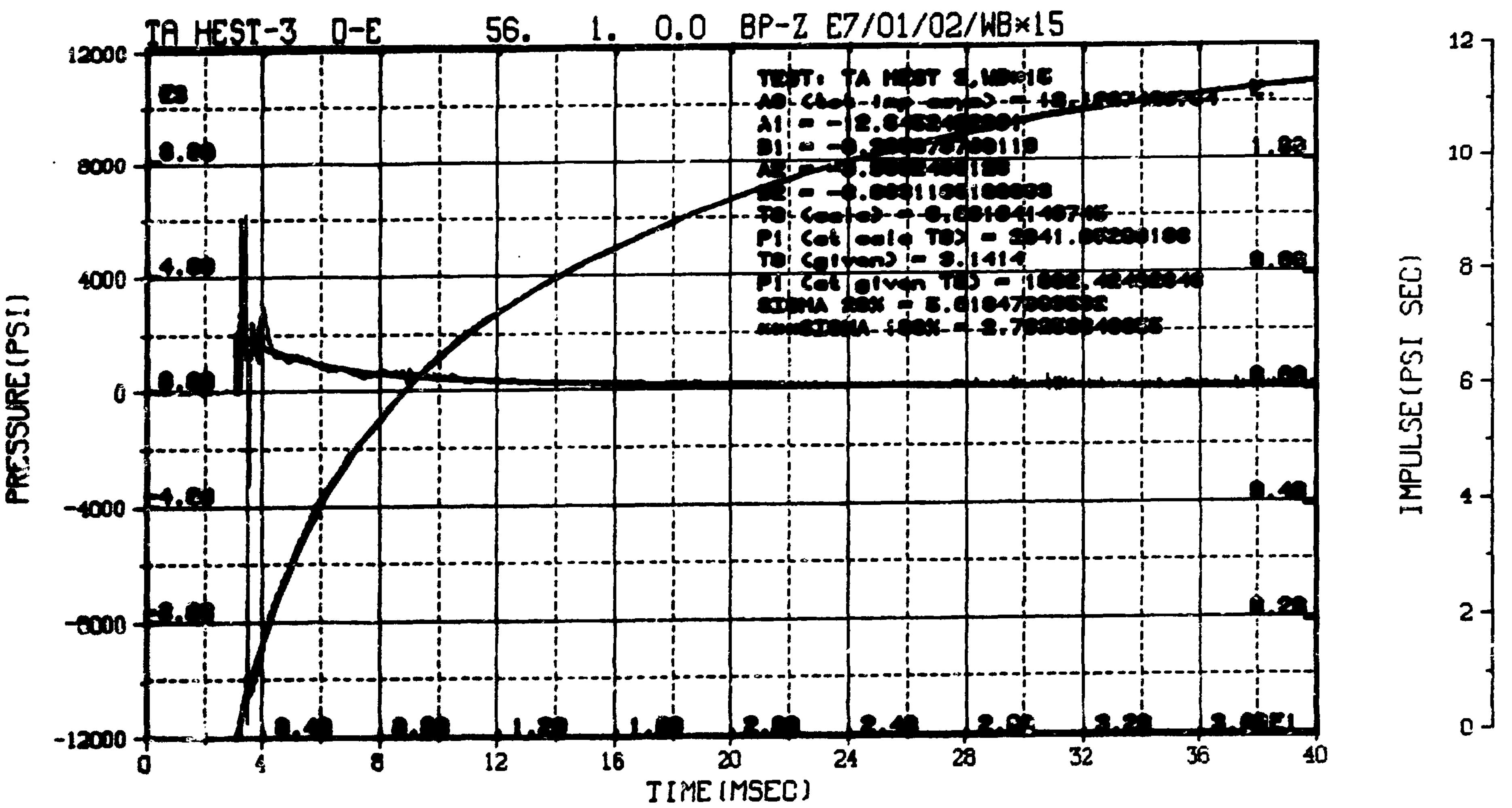

X VS. RESIDUALS FOR: TA WEST 3,WB#14R
E-1
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
0.00
1.00
2.00 E1



M.N. = 15 E.U. =0.000,4108.000 VSN=
TSKIP=12.640 DIGITS=0.000,675.000 TAPE22
S.R. =100.00 KHZ 8 50 AM, 2 MAY 78. FILE=4

1

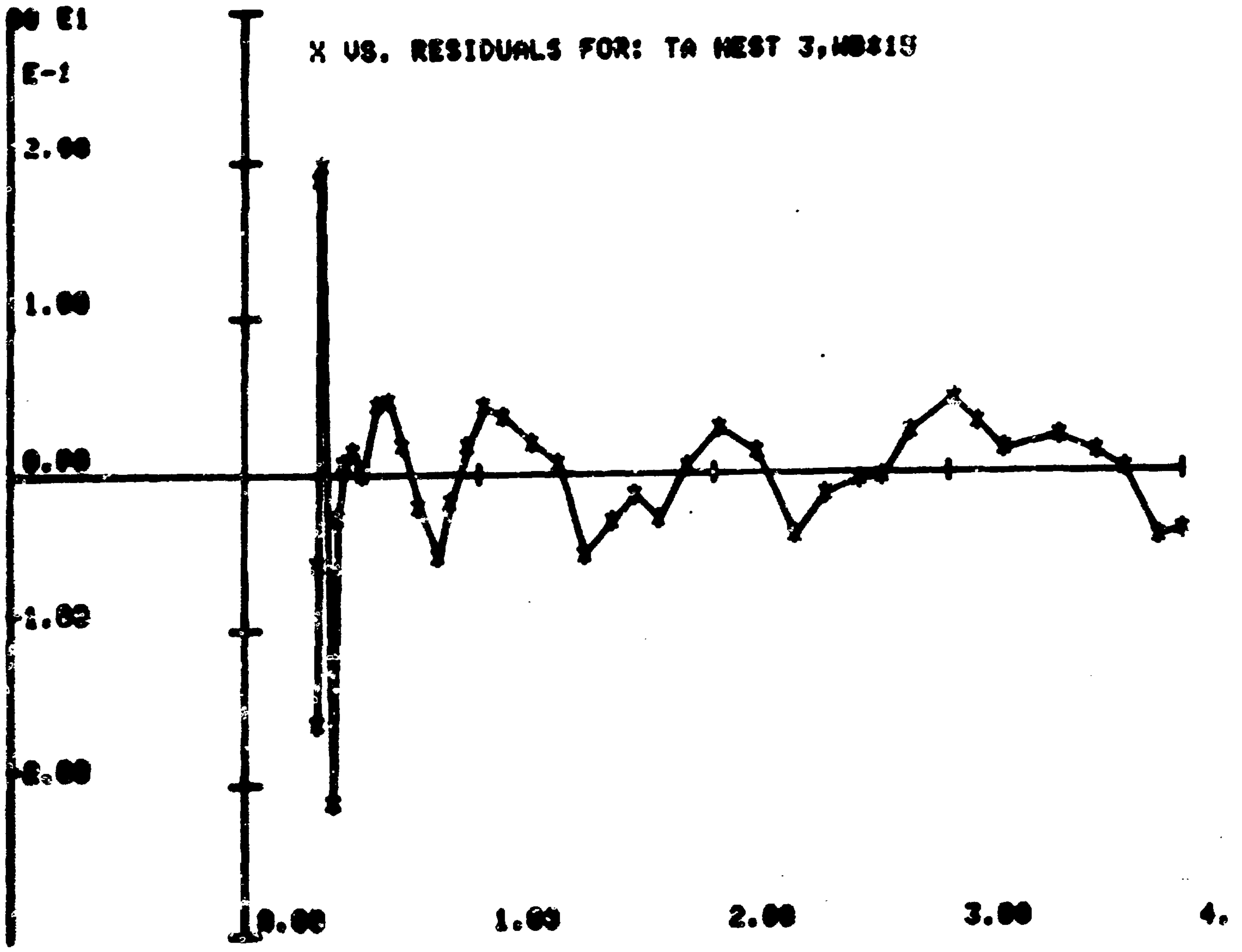

X VS. RESIDUALS FOR: TA WEST 3,WBS15
E-1
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
0.00
0.50
1.00
1.50
2.00
E1

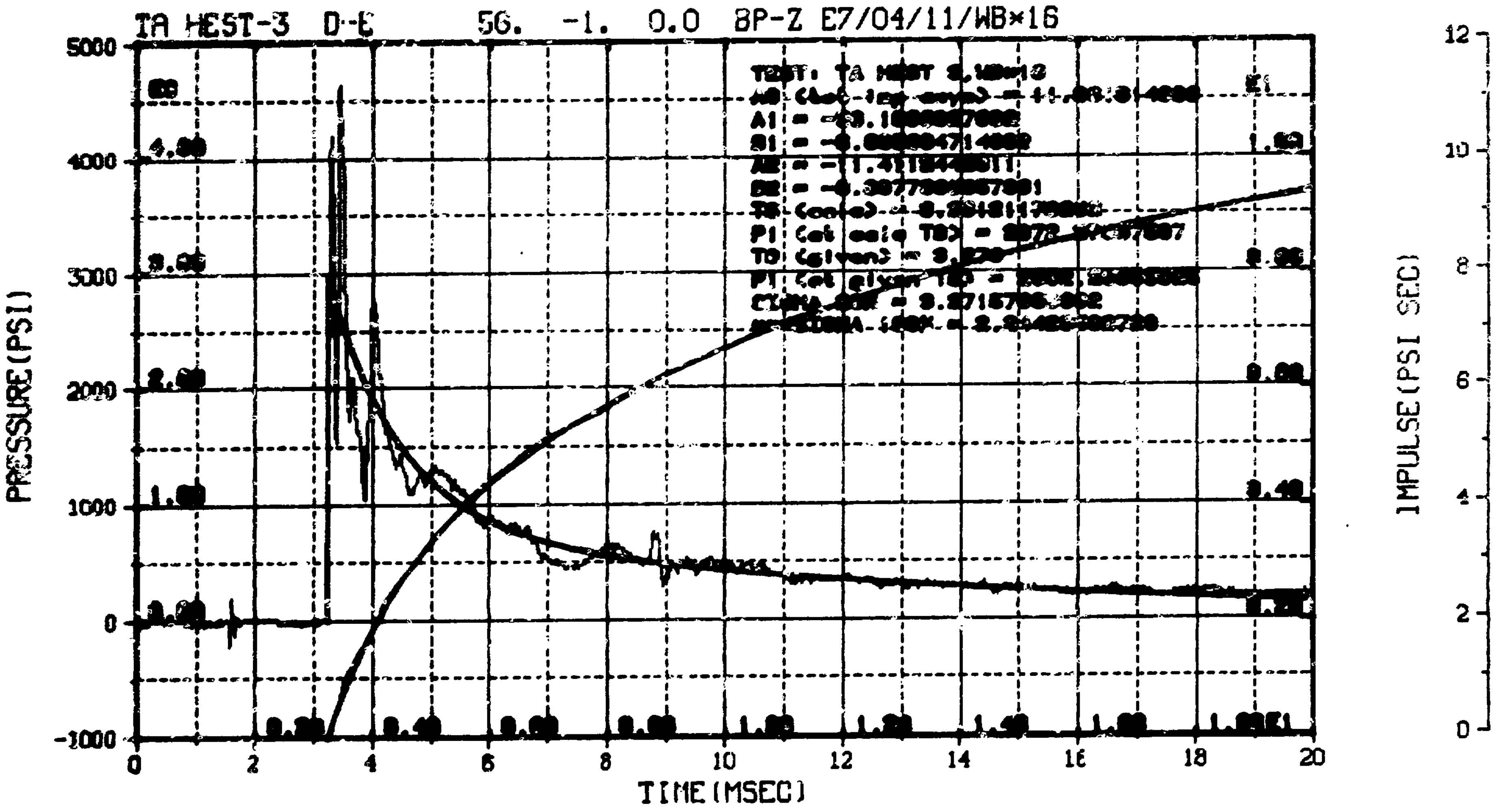


M.N. = 15
TSKIP=12.640
S.R. =100.00 KHZ

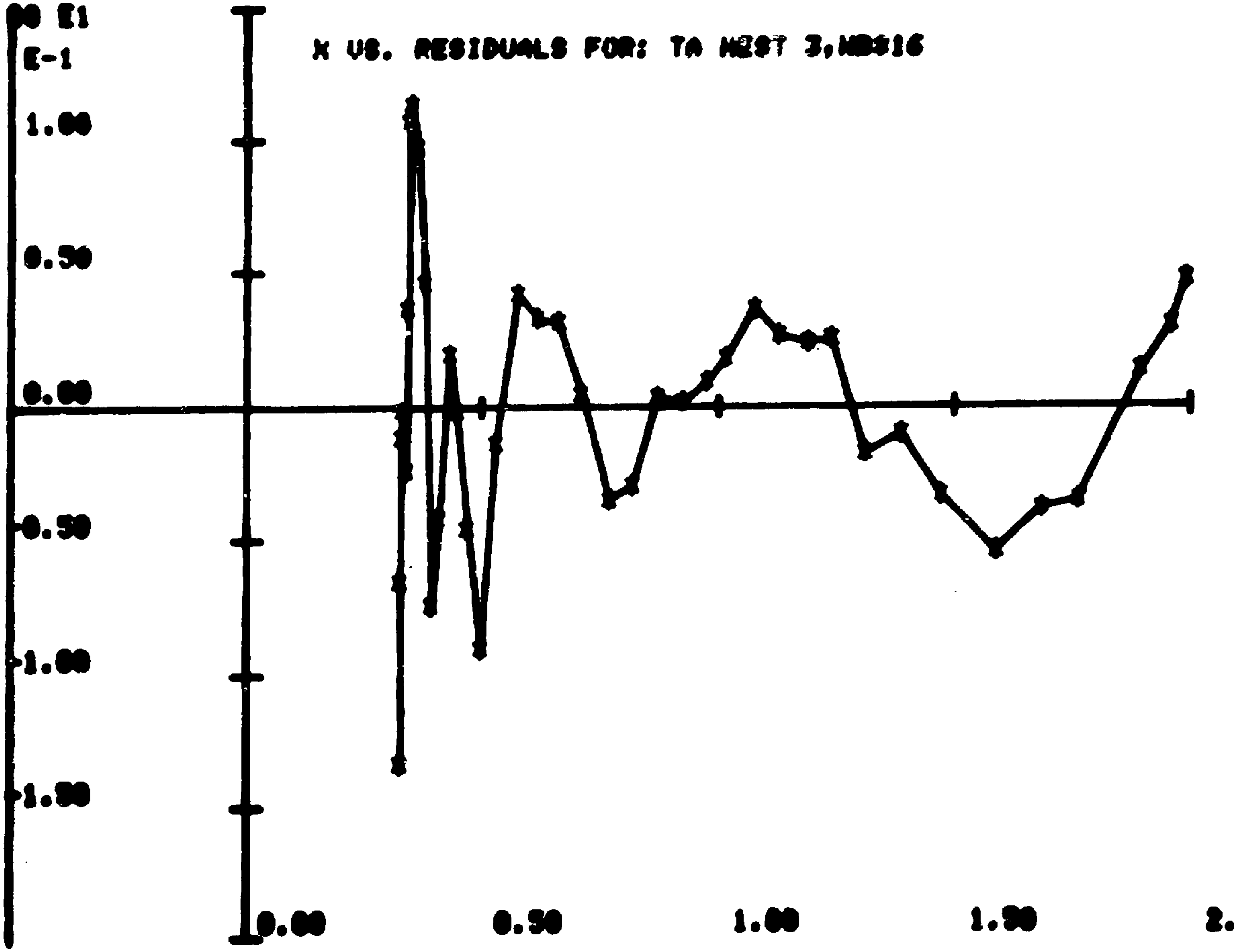
E.U. -0.000,4108.000
DIGITS=0.000,675.000
8 50 AM, 2 MAY 78.

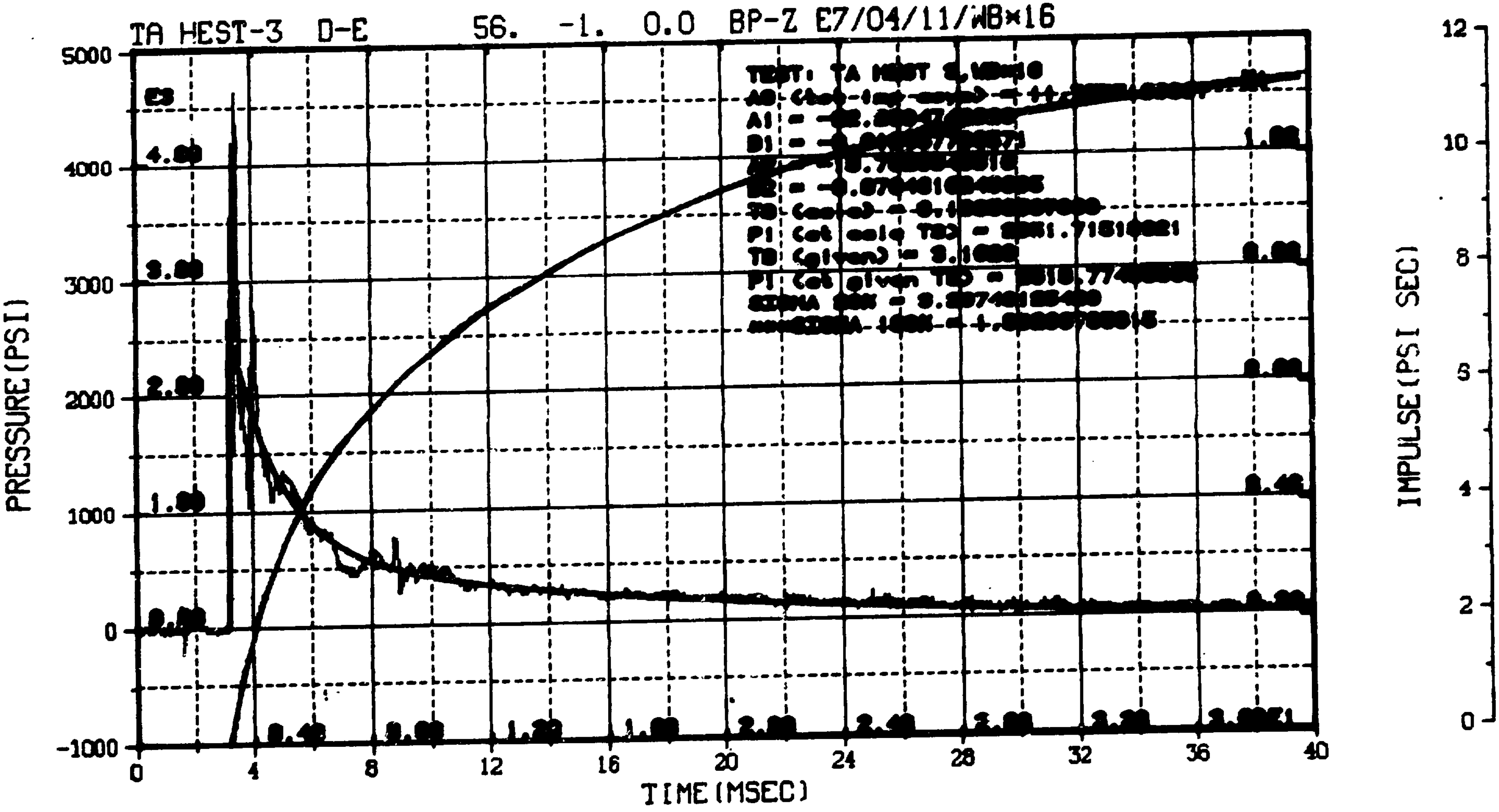
VSN=
TAPE22
FILE=4


X VS. RESIDUALS FOR: TA WEST 3,WB#19
E1
E-1
2.00
1.00
0.00
1.00
2.00
0.00
1.00
2.00
3.00
4.



M.N. = 16 E.U. =0.000,4093.000 VSN= ED23
SKIP=12.650 DIGITS=0.000,680.000 TAPE22
.R. =100.00 KHZ 11 36 AM, 2 MAY 78. FILE=46

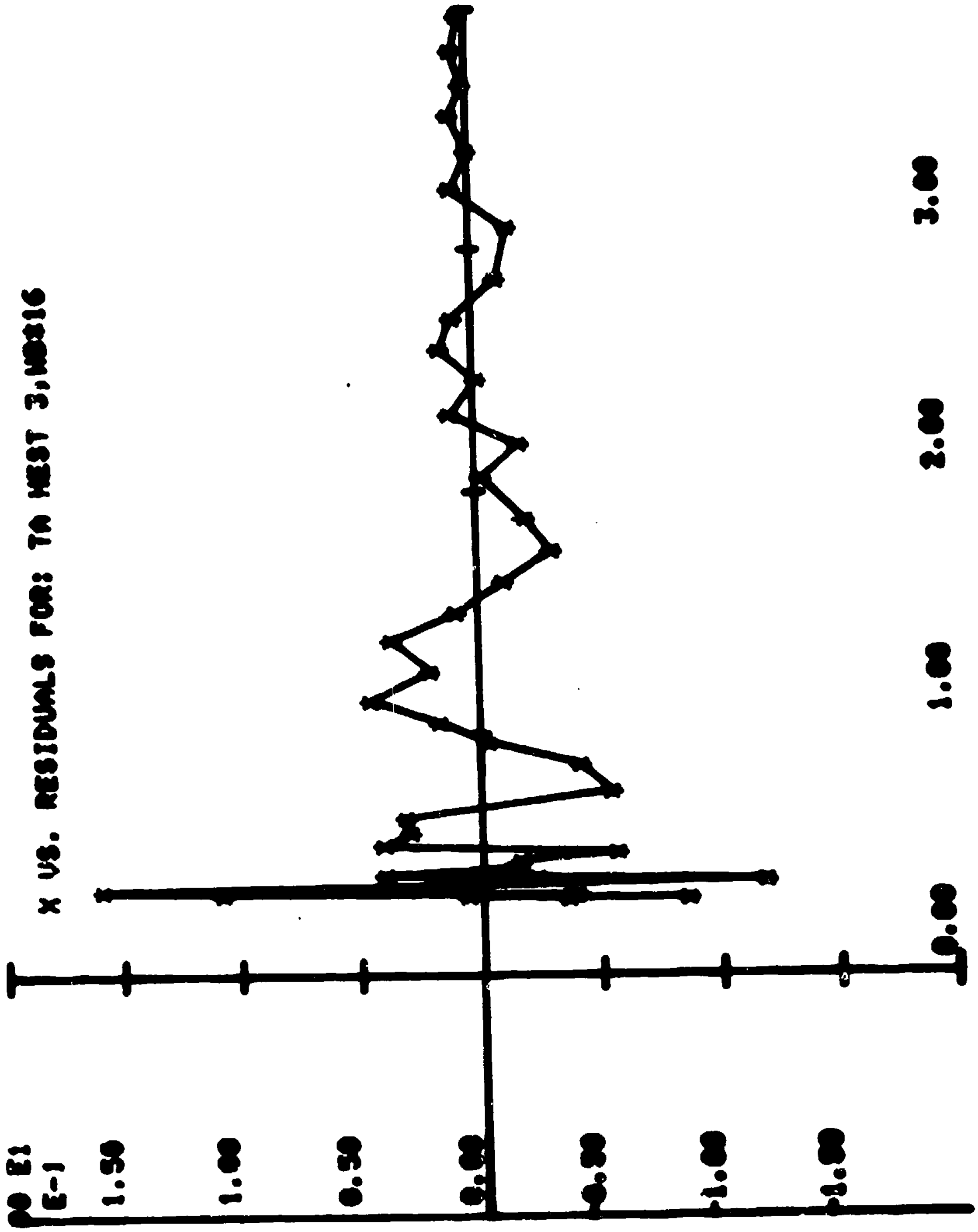

X VS. RESIDUALS FOR: TA WEST 3,NBS16
0 E1
E-1
1.00
0.50
0.00
-0.50
-1.00
-1.50
0.00
0.50
1.00
1.50
2.

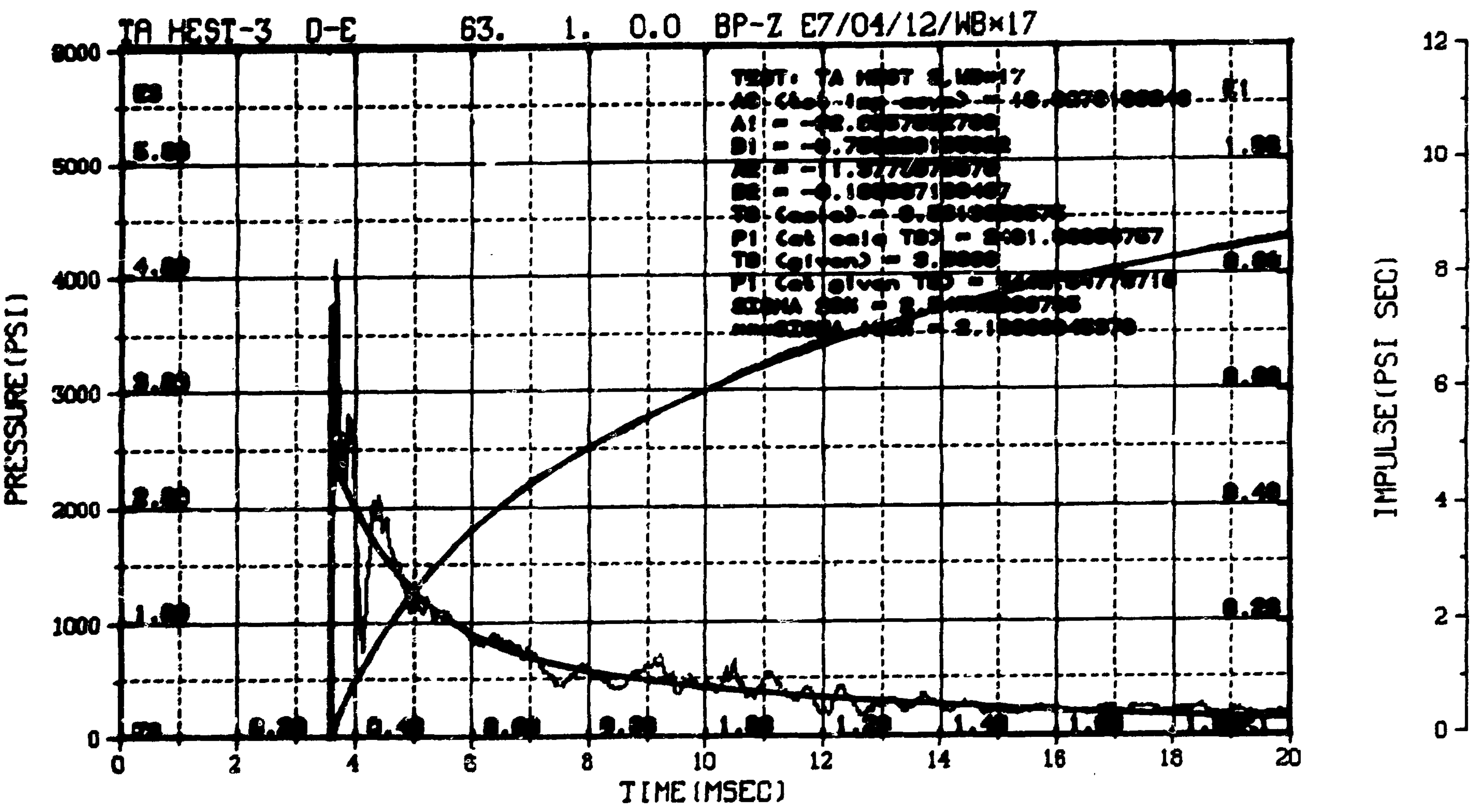


M.N. = 16
TSKIP=12.650
S.R. =100.00 KHZ

E.U. =0.000,4093.000
DIGITS=0.000,680.000
8 50 AM, 2 MAY 78.

VSN=
TAPE22
FILE=46
1

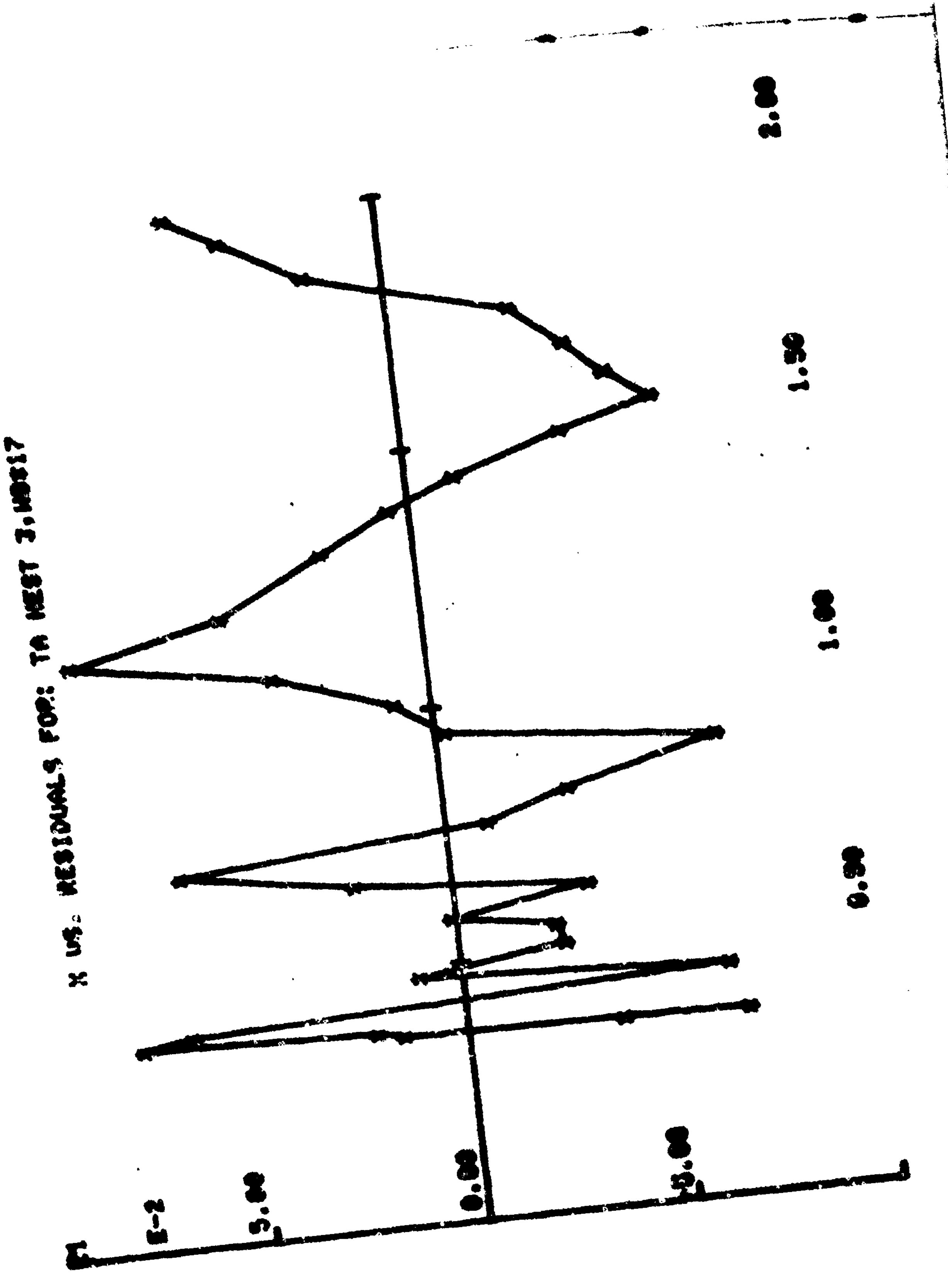

X VS. RESIDUALS FOR: TA WEST 3,MD316
E1
E-1
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
0.00
1.00
2.00
3.00
4.

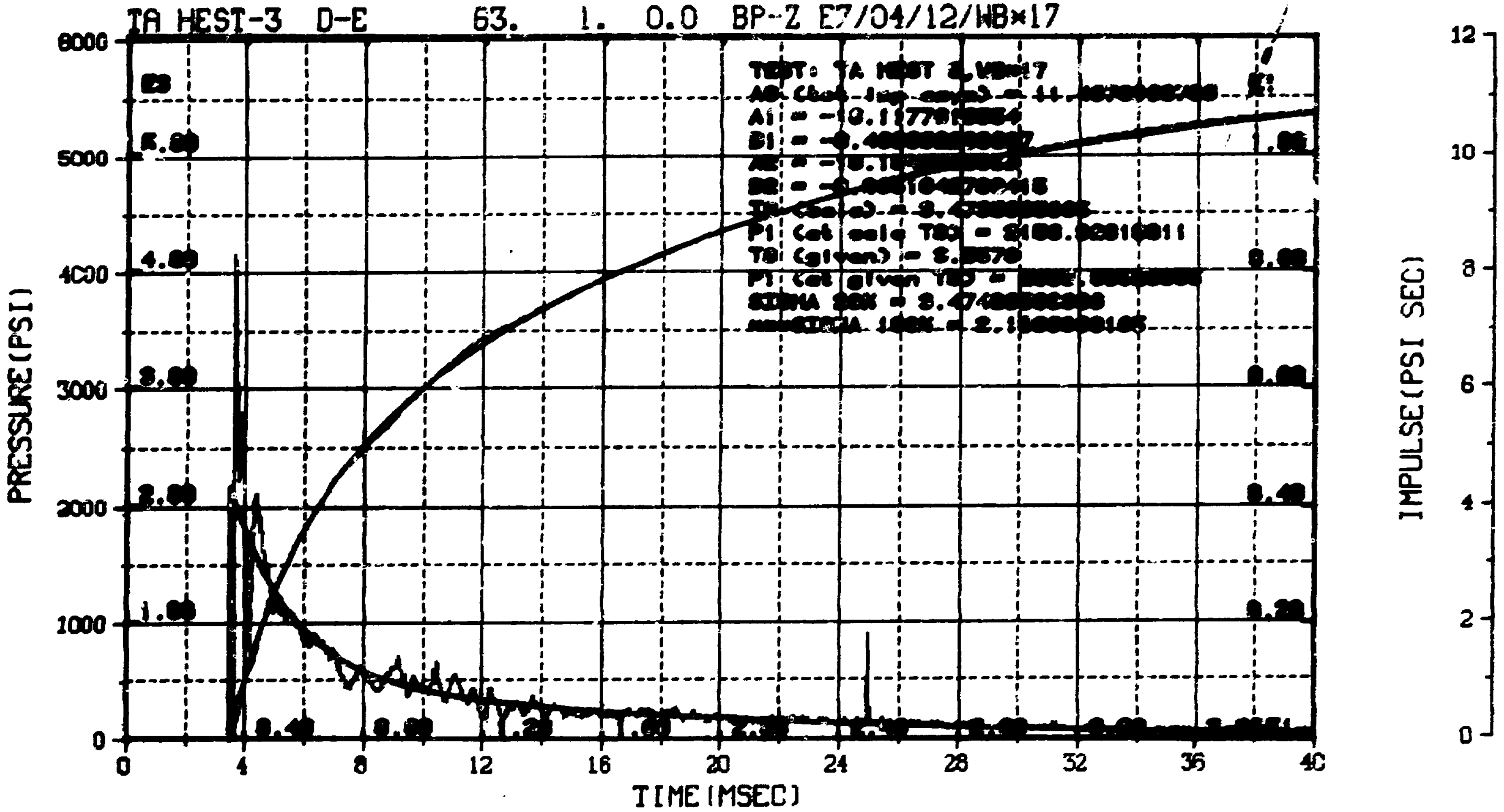


M.N. = 17
TSKIP=12.650
S.R. =100.00 KHZ

E.U. =0.000,4094.000
DIGITS=0.000,760.750
11 36 AM, 2 MAY 78.

VSN= ED23
TAPE22
FILE=48 1


X VS. RESIDUALS FOR: TA WEST 3,W3517
0.50
1.00
1.50
2.00
E-2
5.00
0.00
5.00

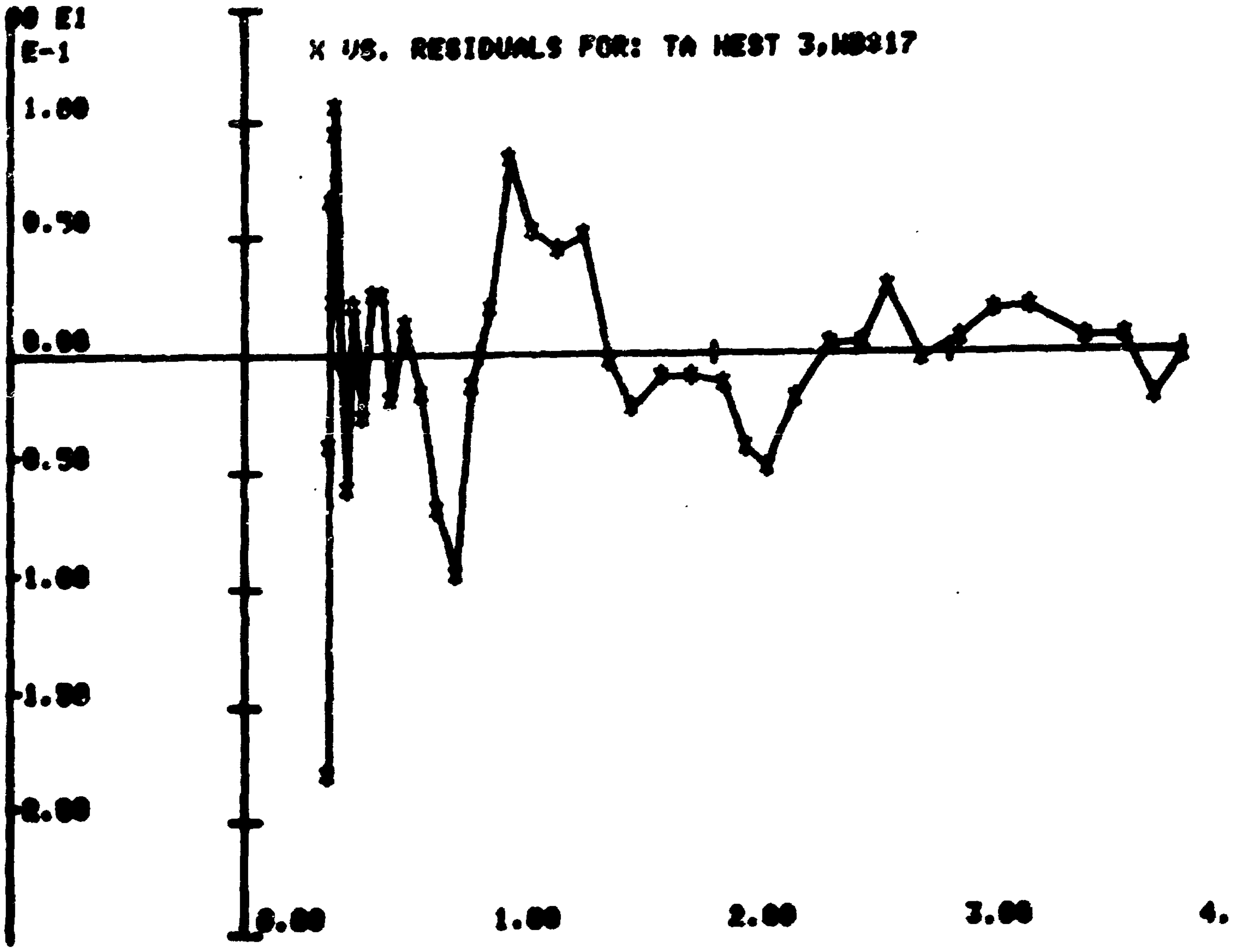


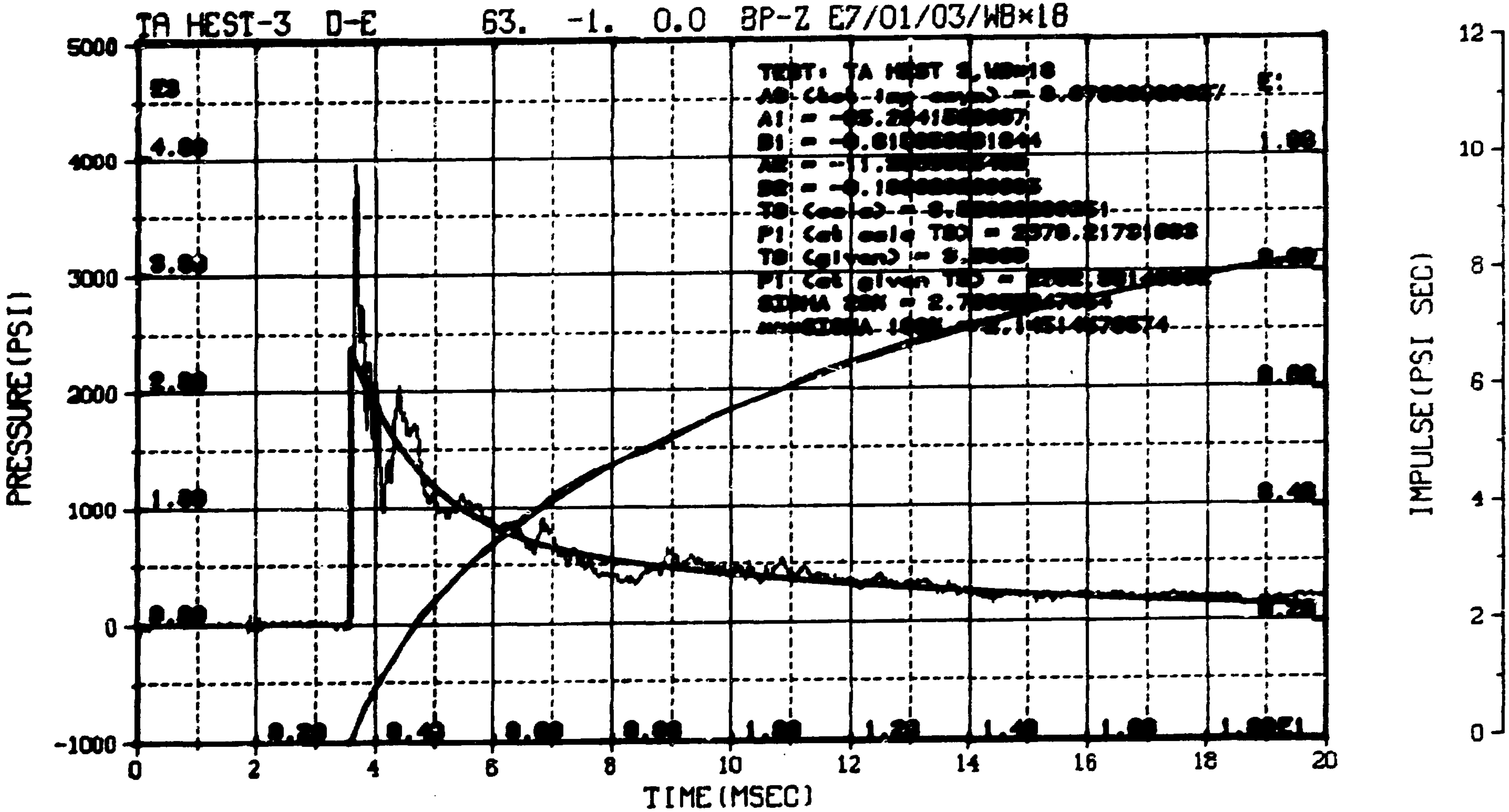
M.N. = 17
TSKIP=12.650
S.R. =100.00 KHZ

E.U. =0.000,4094.000
DIGITS=0.000,760.750
8 50 AM, 2 MAY 78.

VSN=
TAPE22
FILE=48

1


X VS. RESIDUALS FOR: TA WEST 3,WB217
00 E1
E-1
1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
0.00
1.00
2.00
3.00
4.

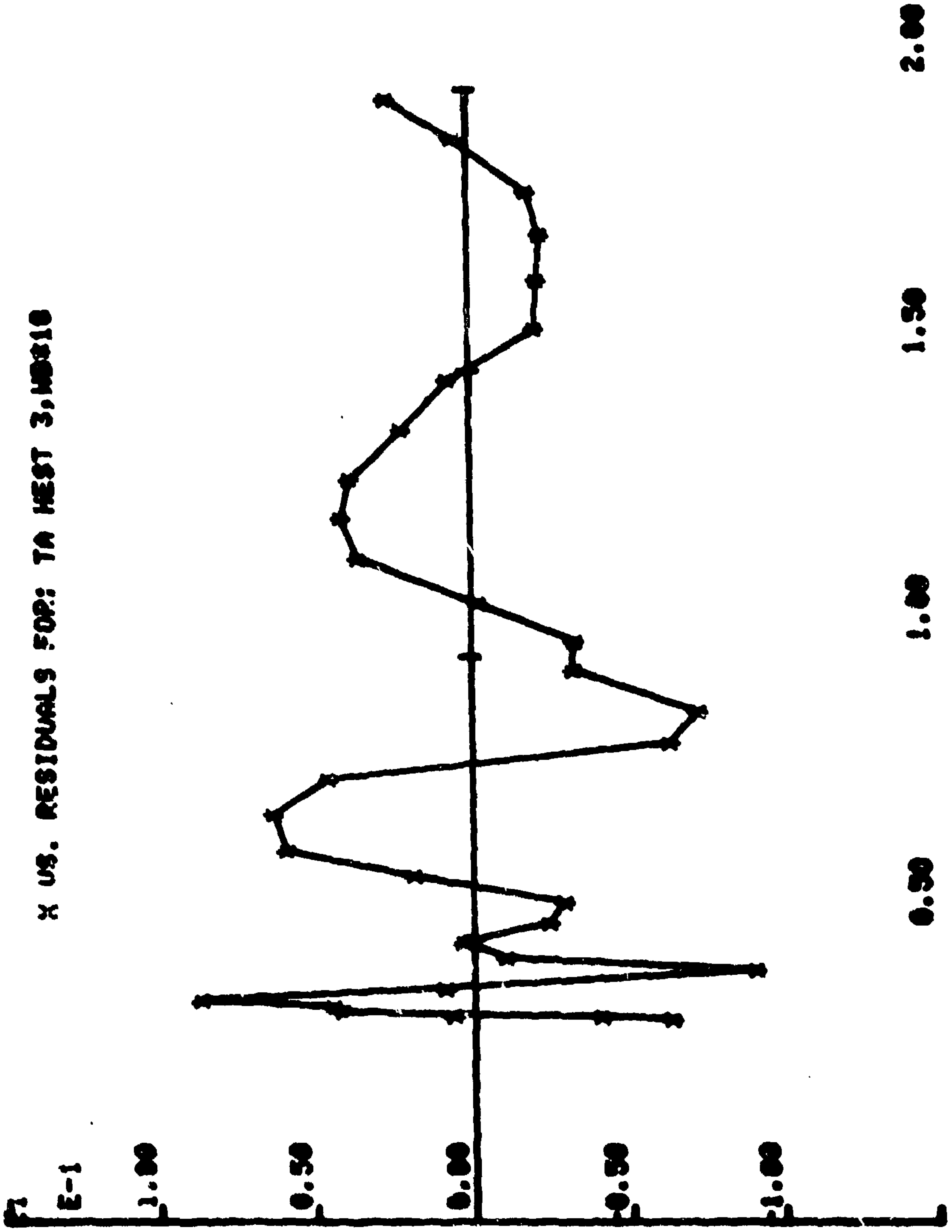


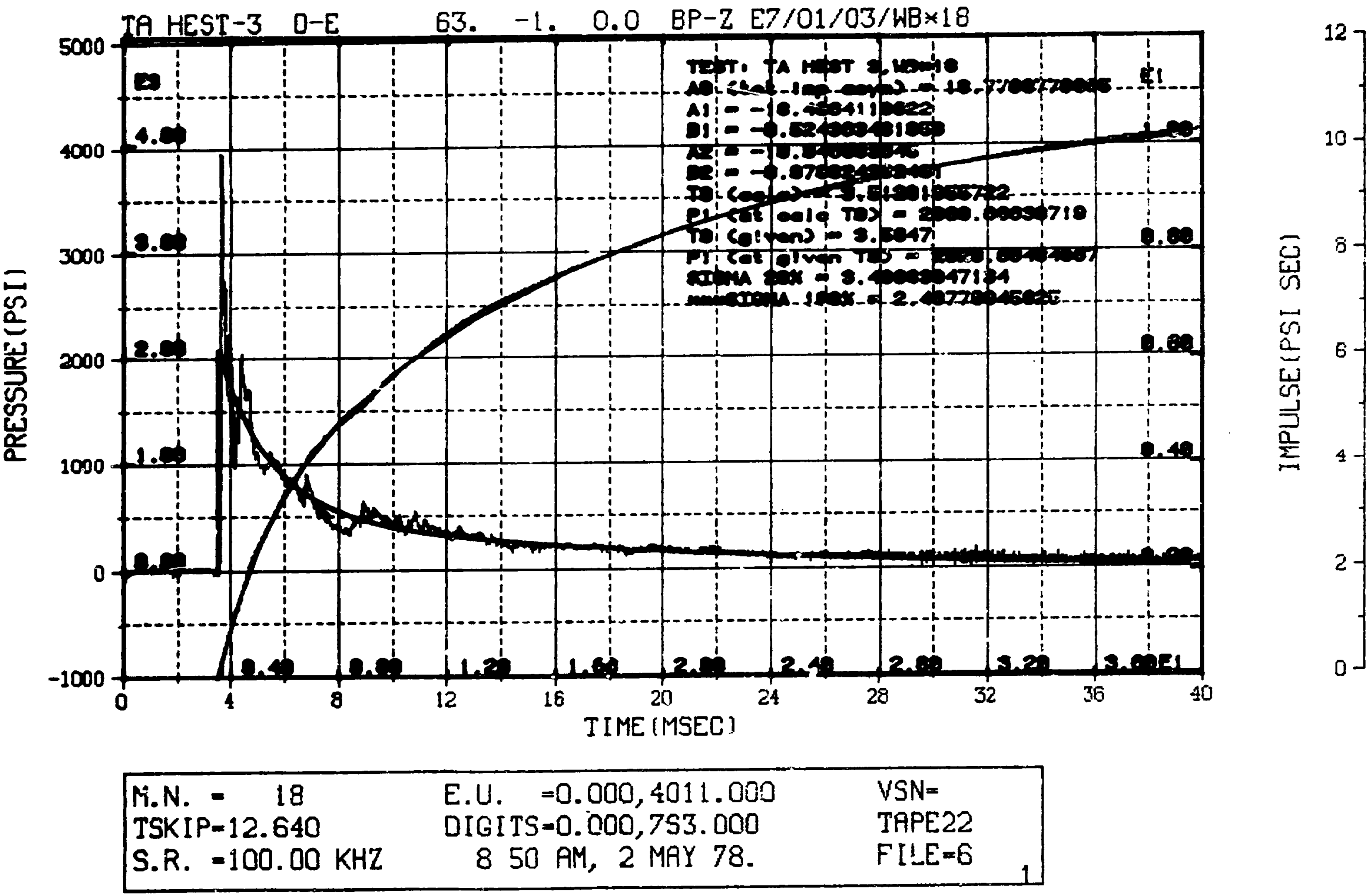
M.N. = 18
TSKIP=12.640
S.R. =100.00 KHZ

E.U. =0.000,4011.000
DIGITS=0.000,763.000
8 50 AM, 2 MAY 78.

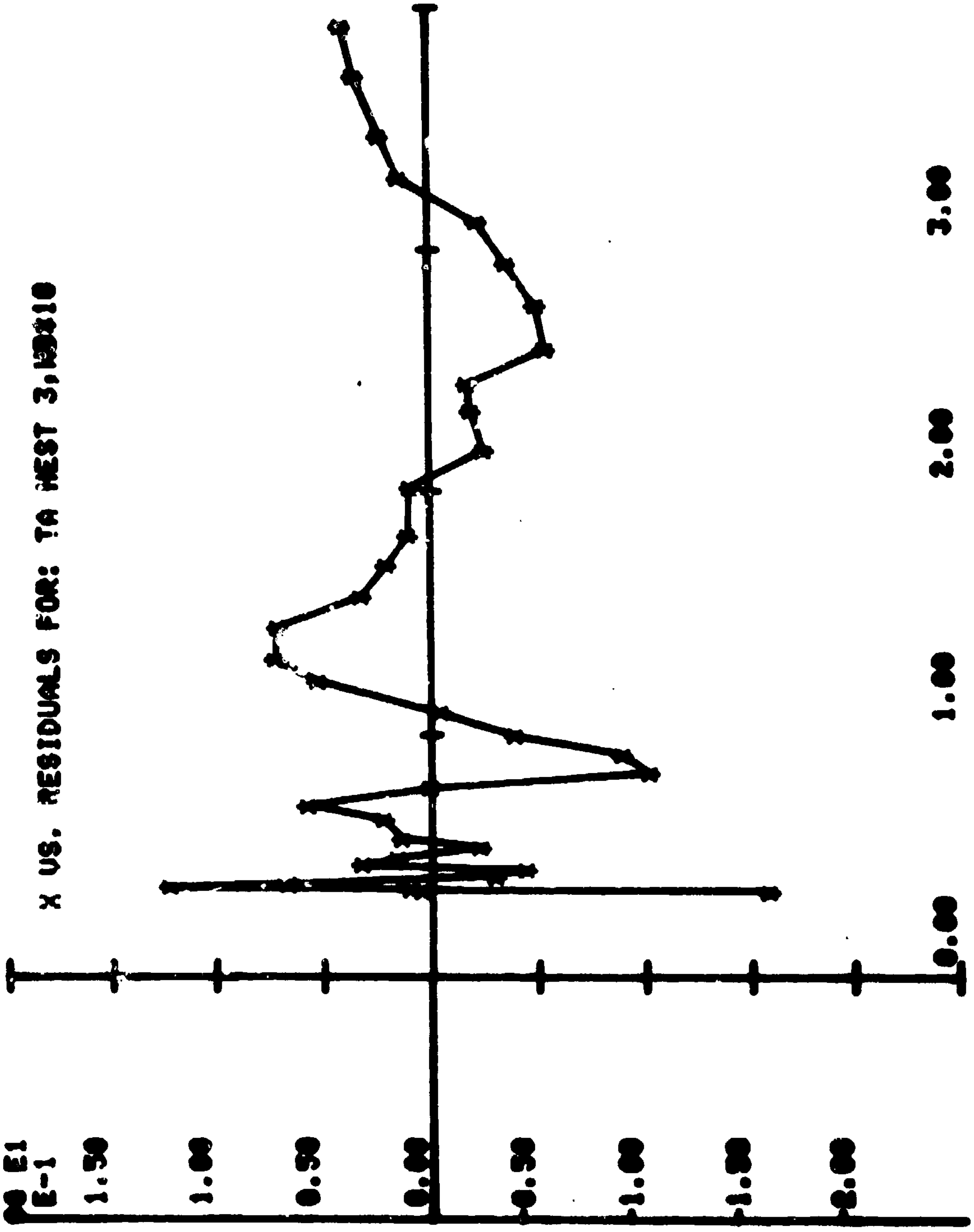
VSN=
TAPE22
FILE=6

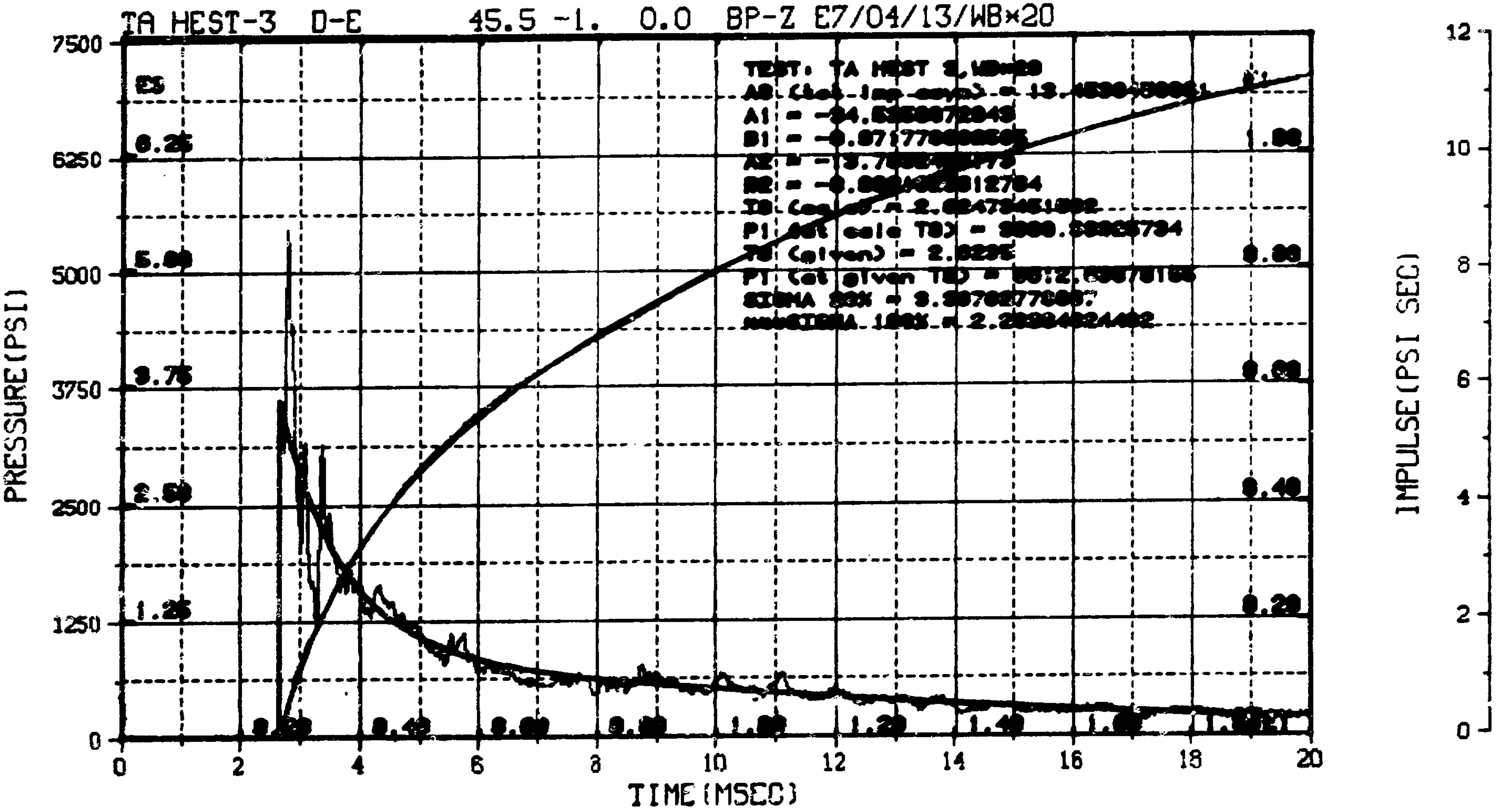
1


X VS. RESIDUALS FOR: TA WEST 3,WB318
E-1
1.00
0.50
0.00
-0.50
-1.00
0.50
1.00
1.50
2.00



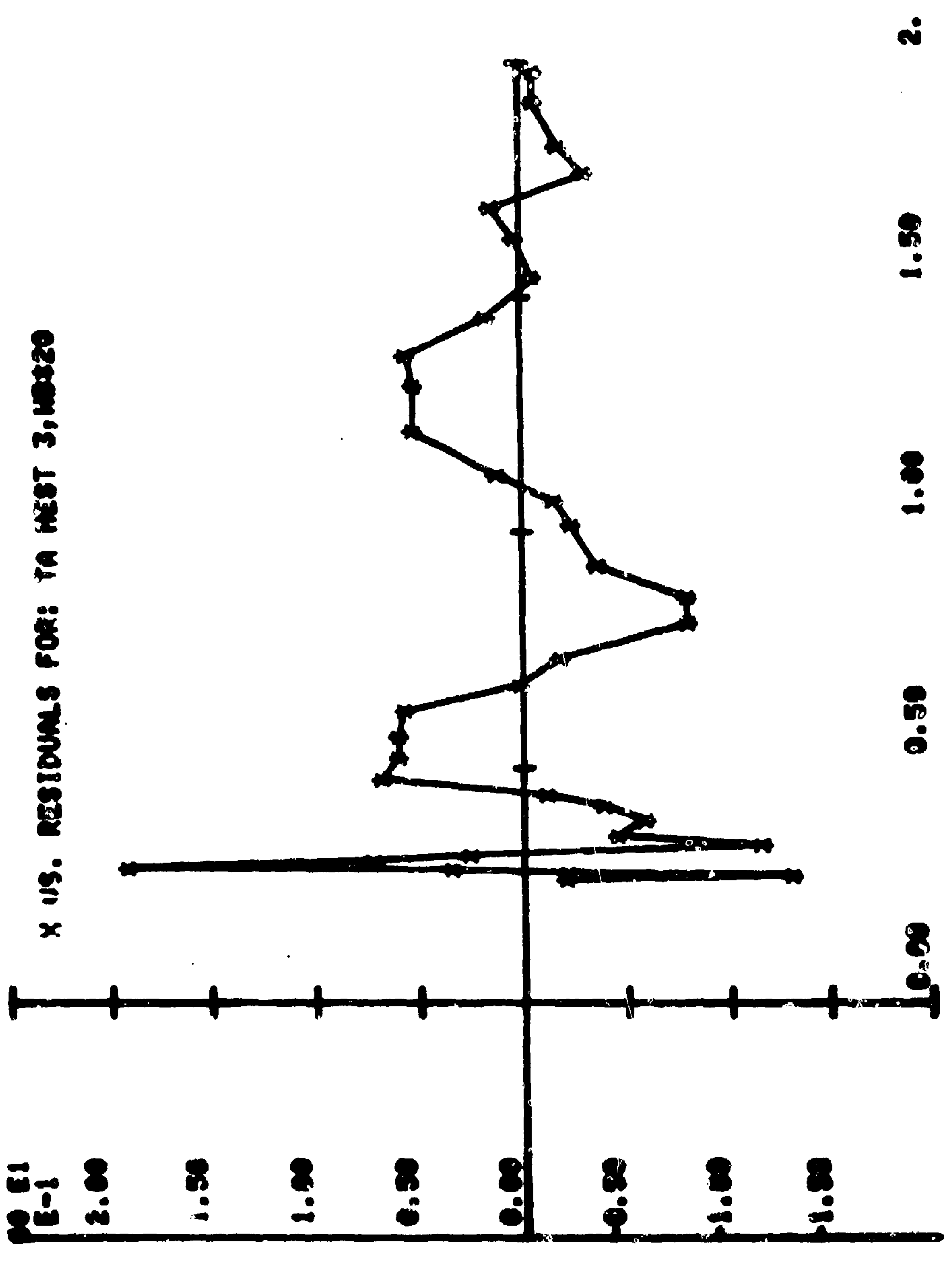
M.N. = 18 E.U. =0.000,4011.000 VSN=
TSKIP=12.640 DIGITS=0.000,753.000 TAPE22
S.R. =100.00 KHZ 8 50 AM, 2 MAY 78. FILE=6

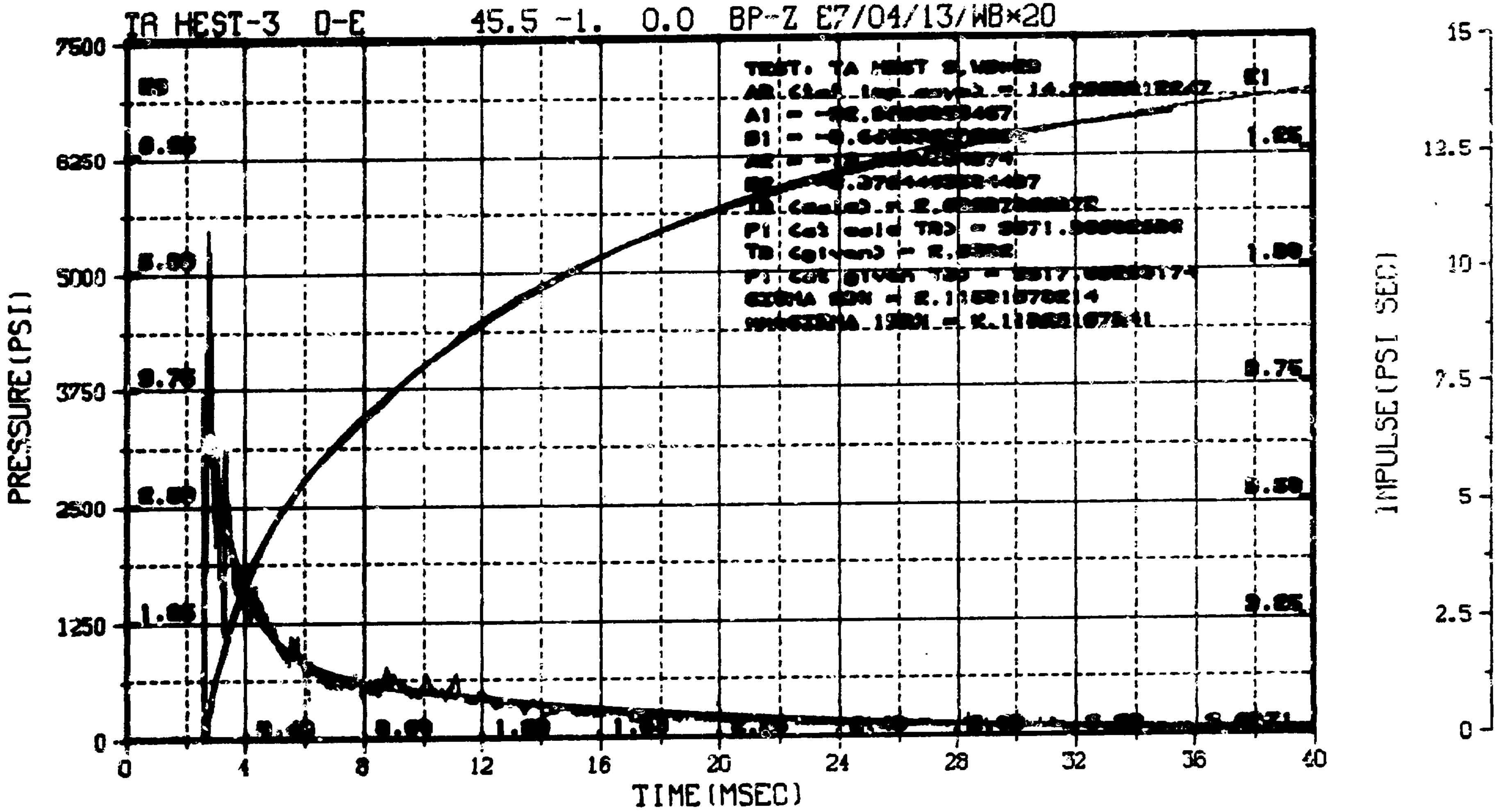

X VS. RESIDUALS FOR: TA WEST 3,10X10
E1
E-1
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
0.00
1.00
2.00
3.00



M.N. = 20 E.U. -0.000,4175.000 VSN- ED23
TSKIP-12.650 DIGITS-0.000,614.500 TAPE22
S.R. -100.00 KHZ 11 35 AM, 2 MAY 78. FILE-50

1

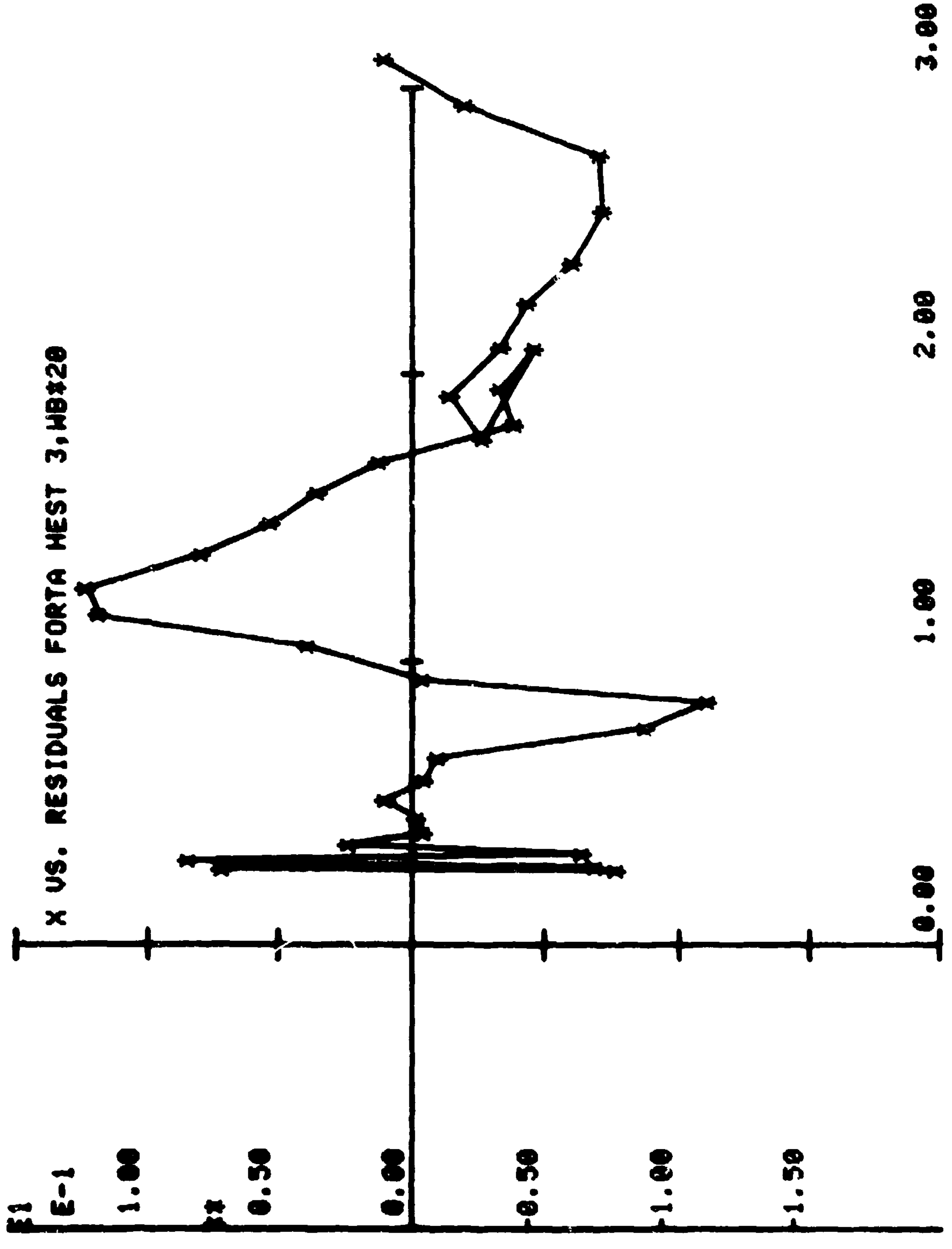

X VS. RESIDUALS FOR: YA WEST 3,HB320
0 E1
E-1
2.00
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
0.00
0.50
1.00
1.50
2.

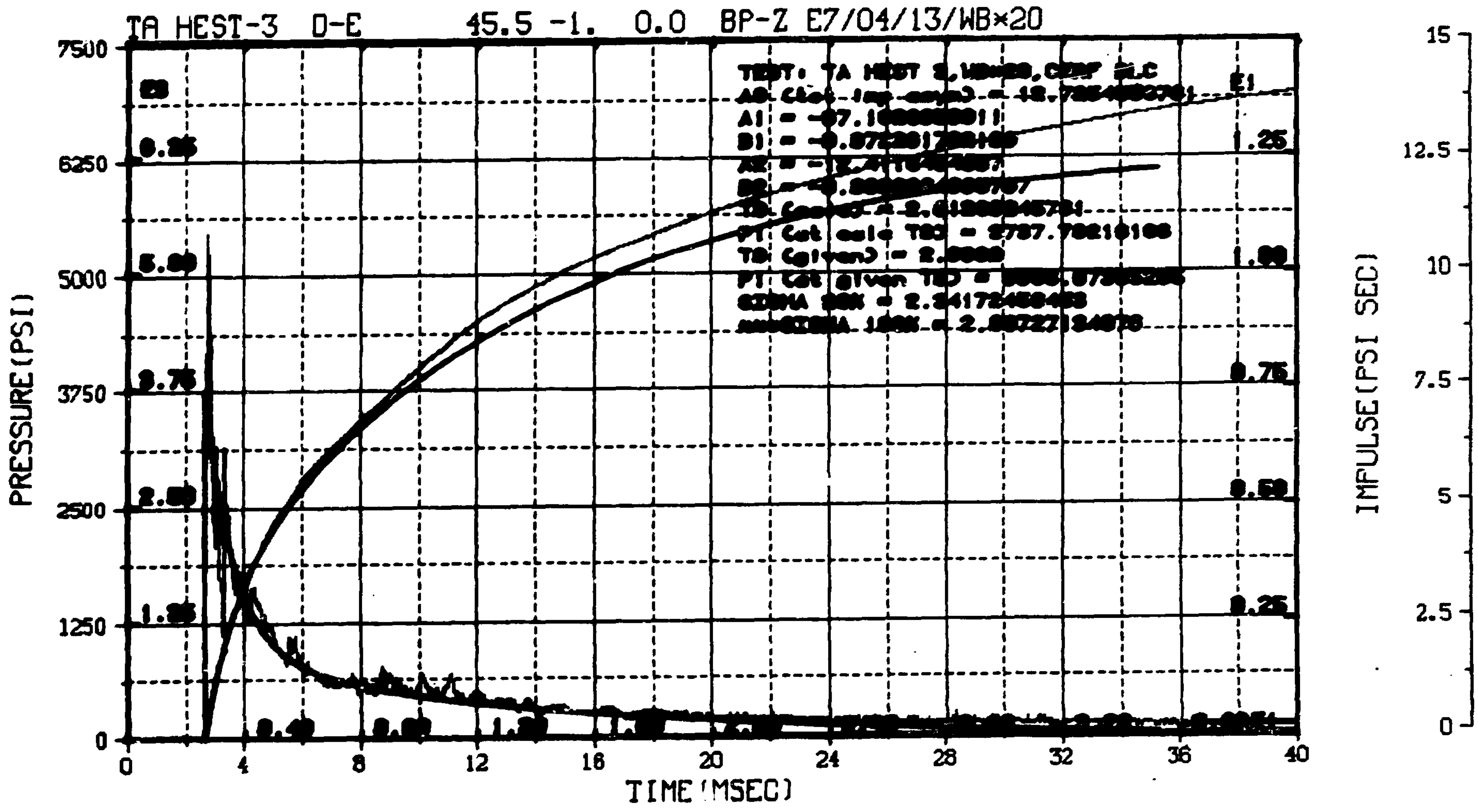


M.N. = 20
TSKIP=12.650
S.R. =100.00 KHZ

E.U. =0.000,4175.000
DIGITS=0.000,614.500
8 50 AM, 2 MAY 78.

VSN=
TAPE22
FILE=50


X VS. RESIDUALS FORTA WEST 3,WB#20
E1
E-1
1.00
0.50
0.00
-0.50
-1.00
-1.50
0.00
1.00
2.00
3.00

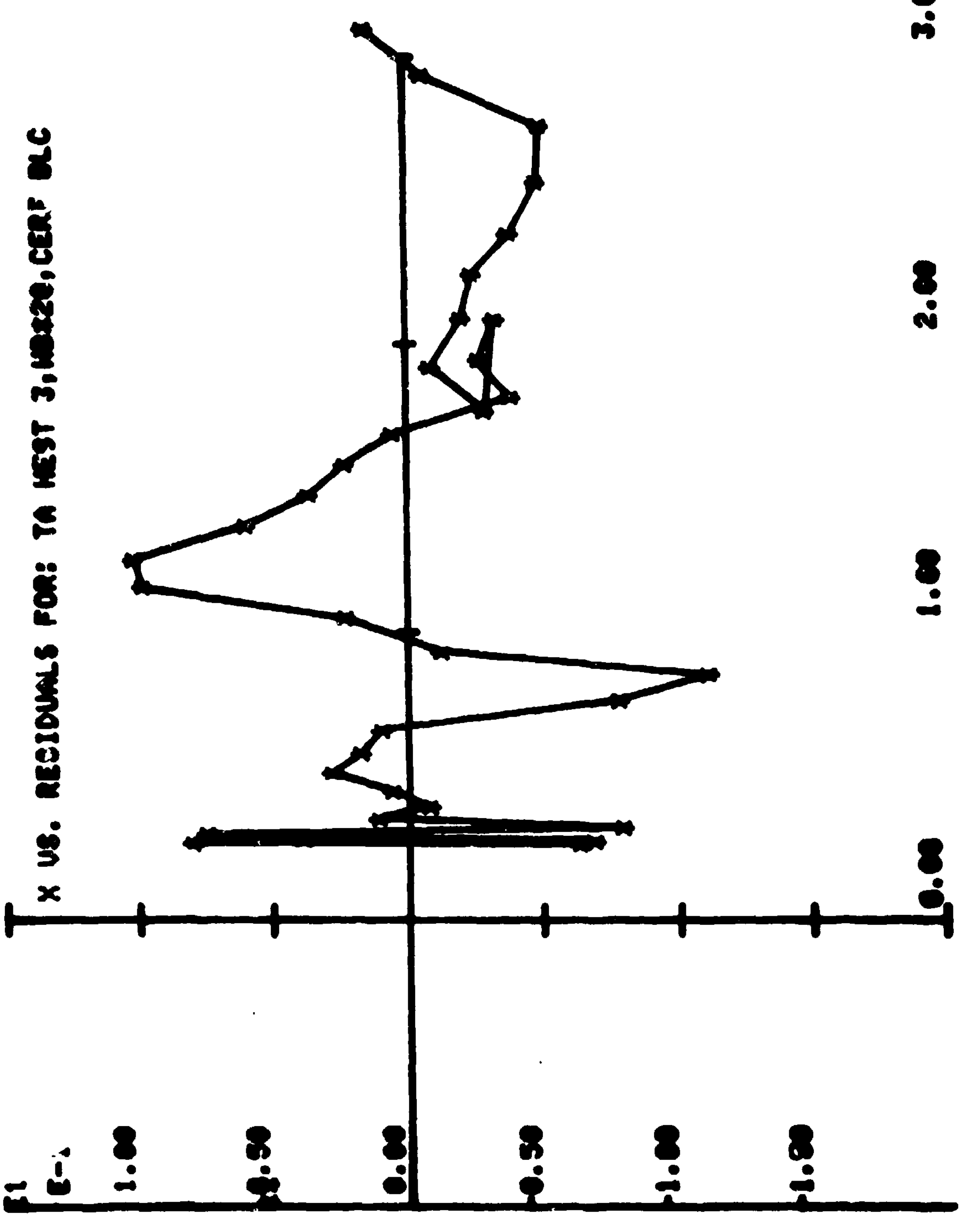


M.N. = 20
TSKIP=12.650
S.R. =100.00 KHZ

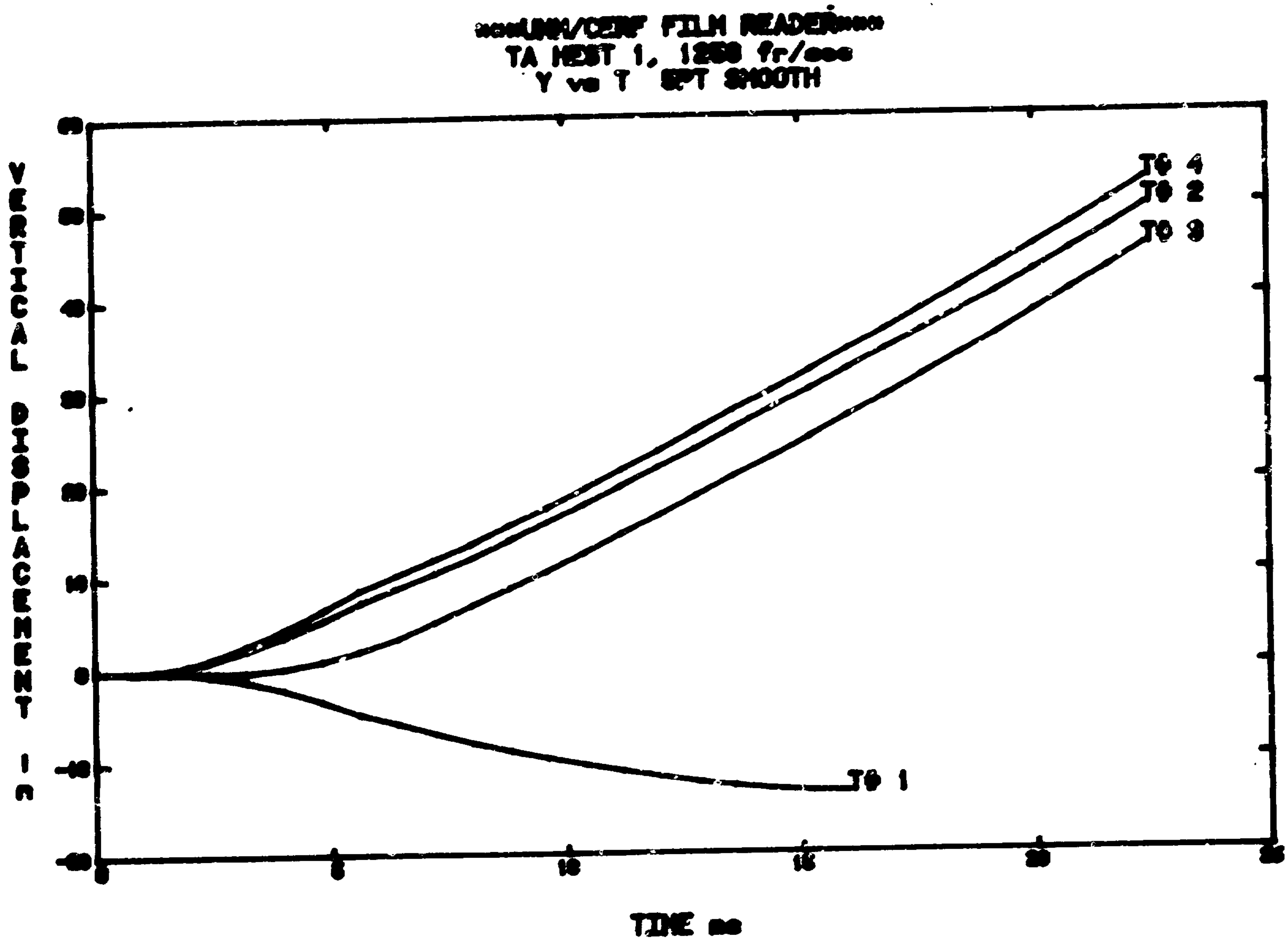
E.U. =0.000,4175.000
DIGITS=0.000,614.500
8 50 AM, 2 MAY 78.

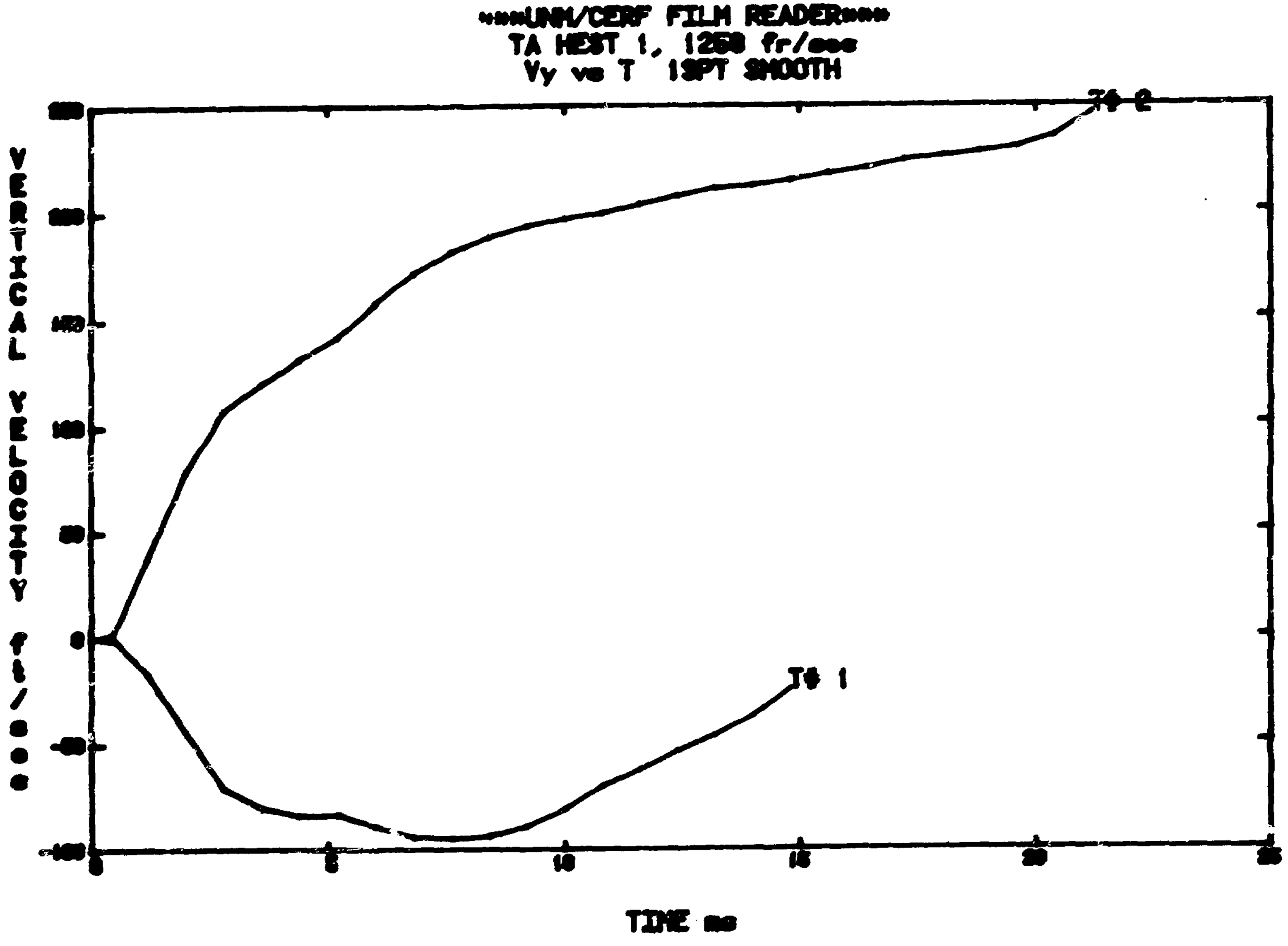
VSN=
TAPE22
FILE=50

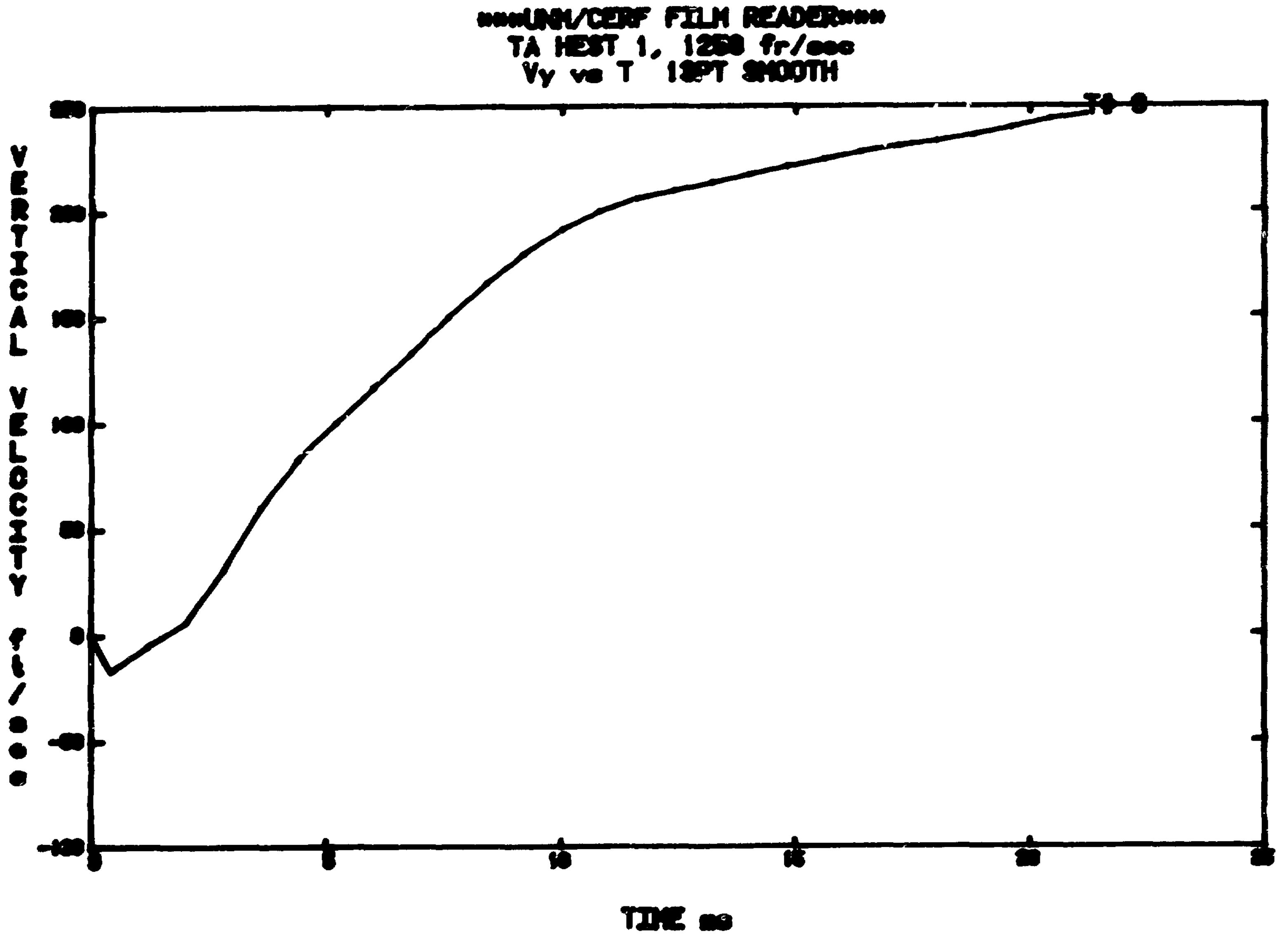
1

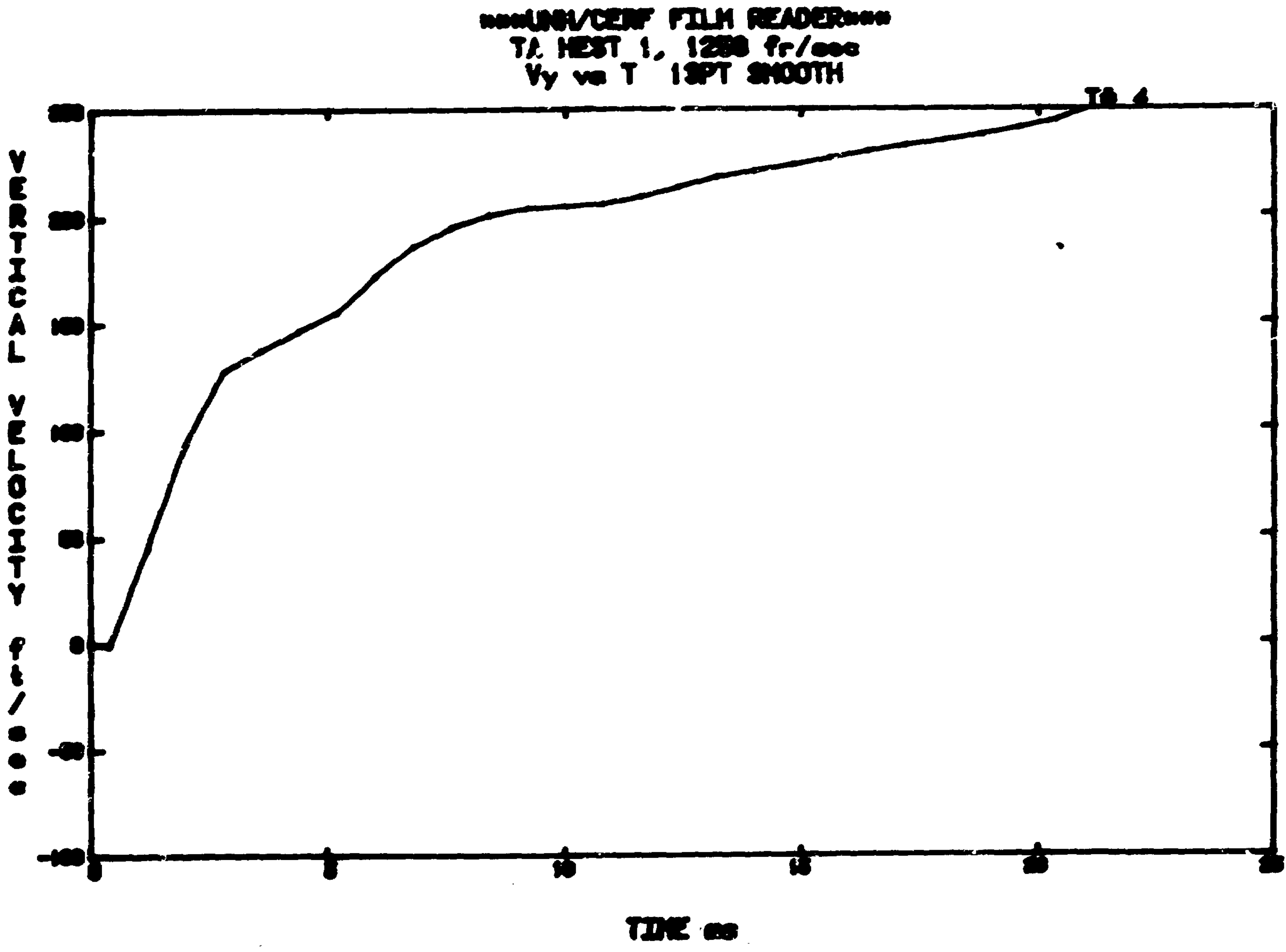

X VS. RESIDUALS FOR: TA WEST 3,NBX20,CERF BLC
E1
E-1
1.00
0.50
0.00
-0.50
-1.00
-1.50
0.00
1.00
2.00
3.00

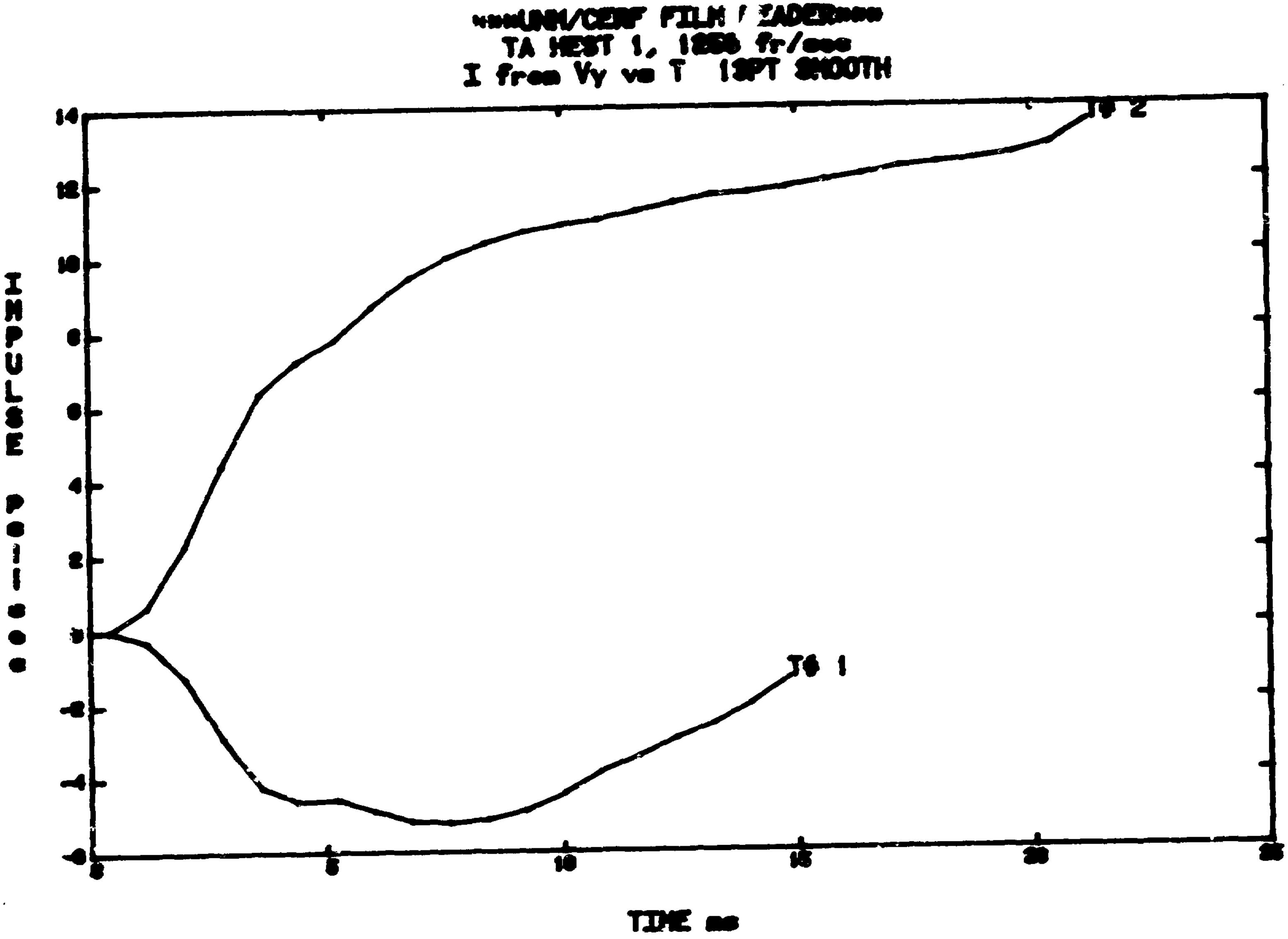
APPENDIX C
PLOTTED PHOTOPOLE DATA

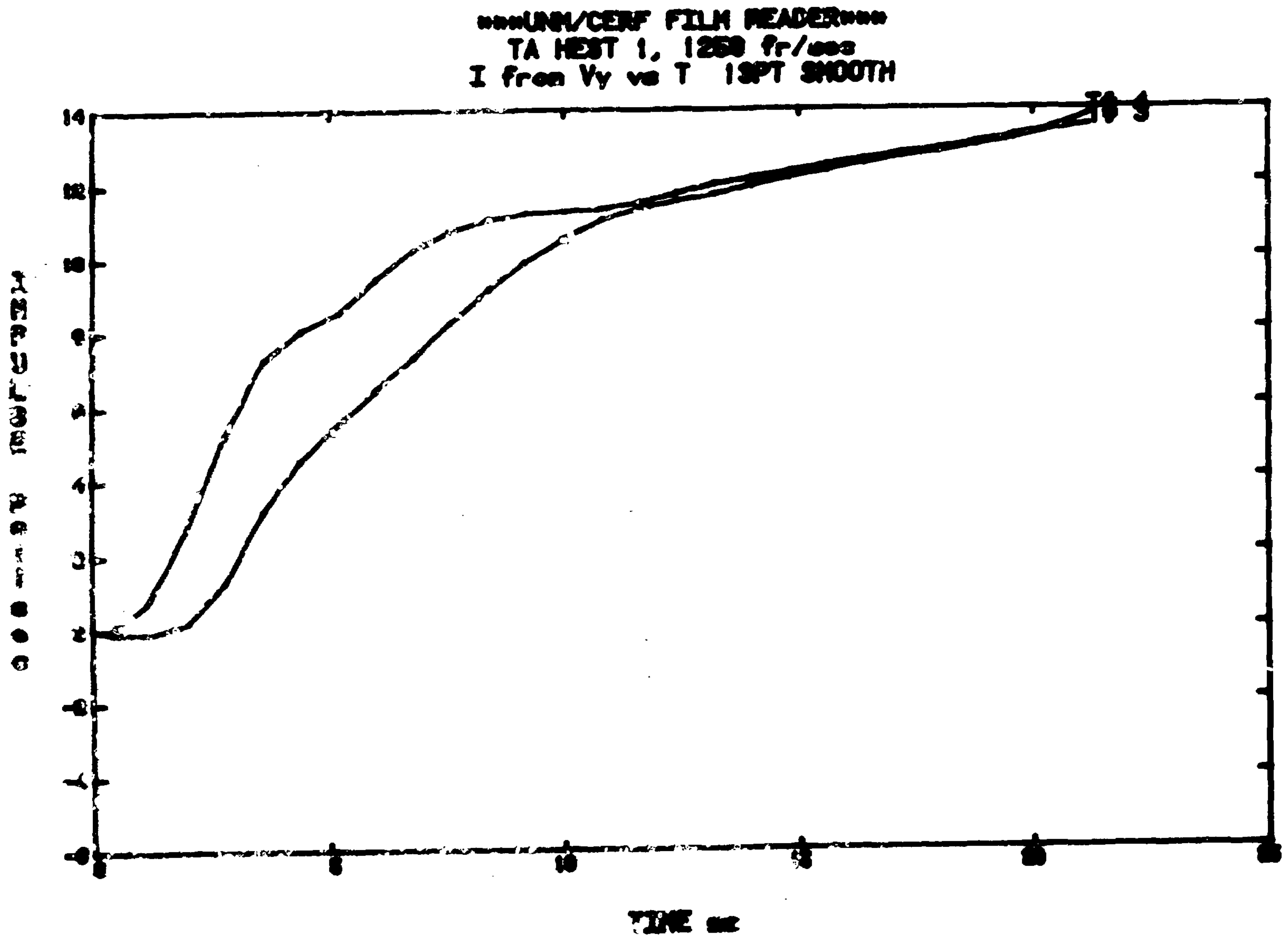

UNM/CERF FILM READER
TA HEST 1, 1250 fr/sec
Y vs T 5PT SMOOTH
VERTICAL DISPLACEMENT in
60
50
40
30
20
10
0
-10
-20
TIME ms
0
5
10
15
20
25
T@ 4
T@ 2
T@ 3
T@ 1

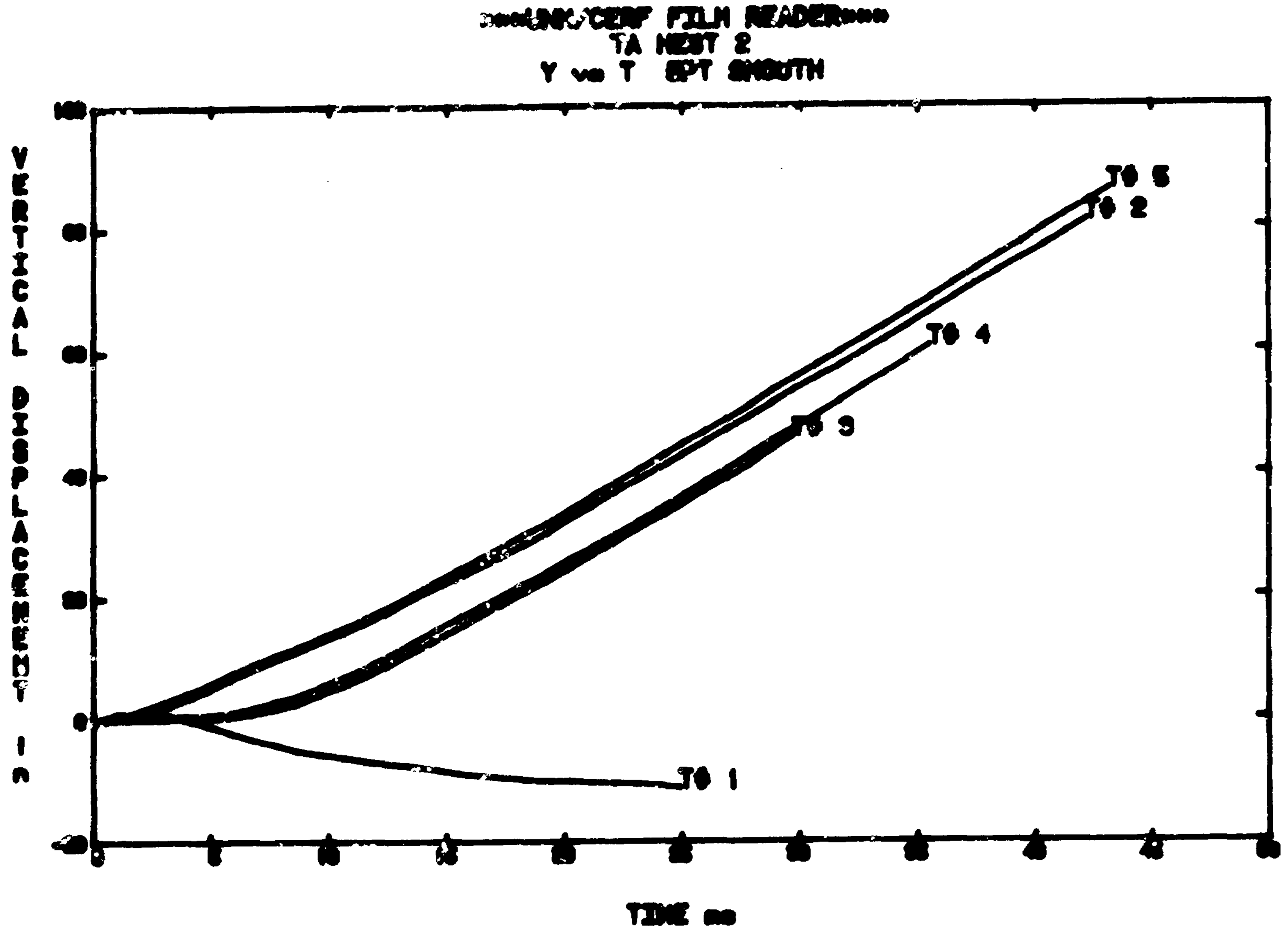

UNM/CERF FILM READER*
TA HEST 1, 1250 fr/sec
Vy vs T 13PT SMOOTH
VERTICAL VELOCITY ft/sec
250
200
150
100
50
0
-50
-100
0
5
10
15
20
25
TIME ms
T# 2
T# 1


****UNM/CERF FILM READER****
TA HEST 1, 1250 fr/sec
Vy vs T 12PT SMOOTH
VERTICAL VELOCITY ft/sec
250
200
150
100
50
0
-50
-100
0
5
10
15
20
25
TIME ms
T# 0

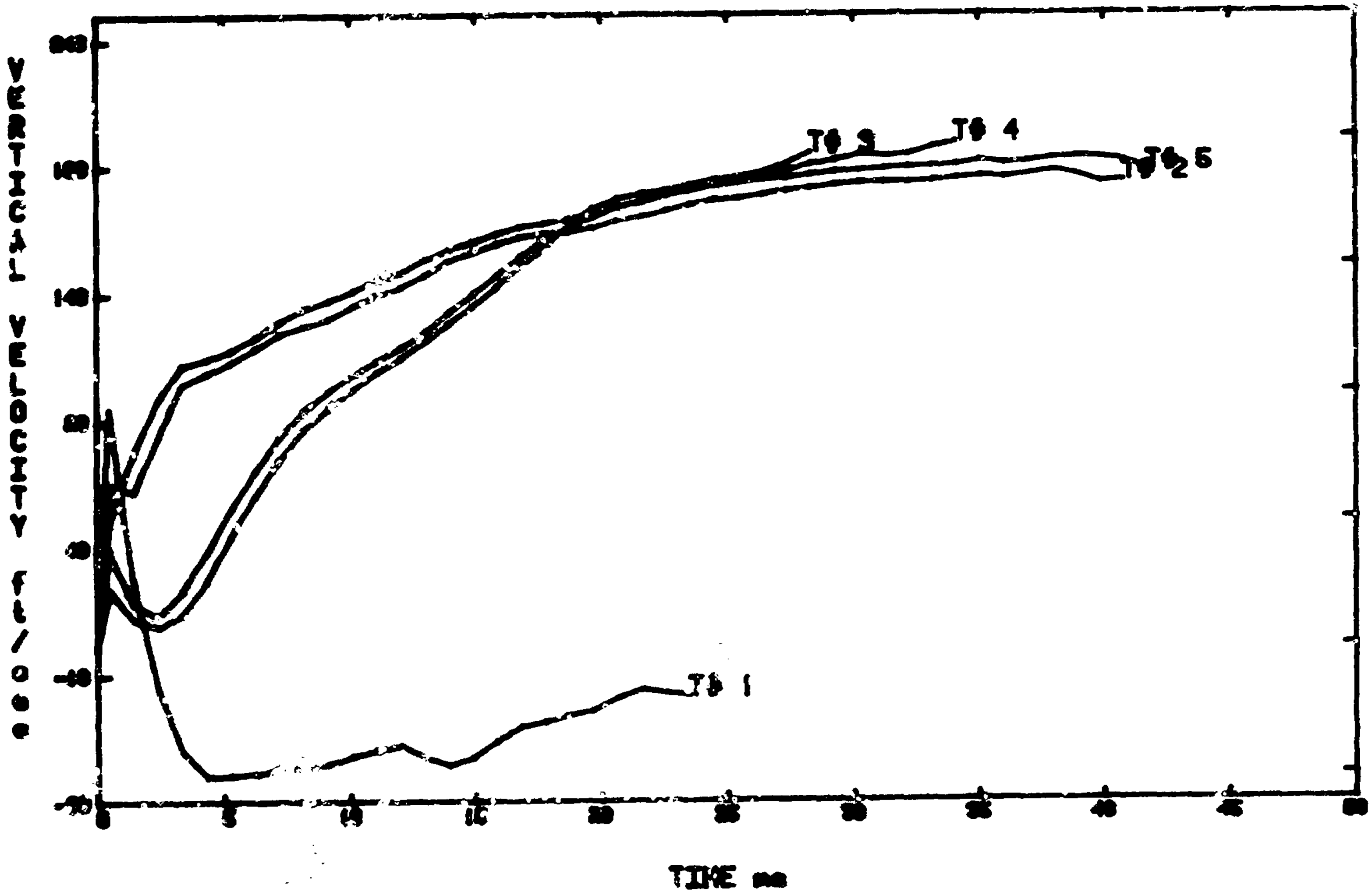

UNH/CERF FILM READER
TA HEST 1, 1200 fr/sec
Vy vs T 13PT SMOOTH
T@ 4
VERTICAL VELOCITY ft/sec
300
250
200
150
100
50
0
-50
-100
0
5
10
15
20
25
TIME ms

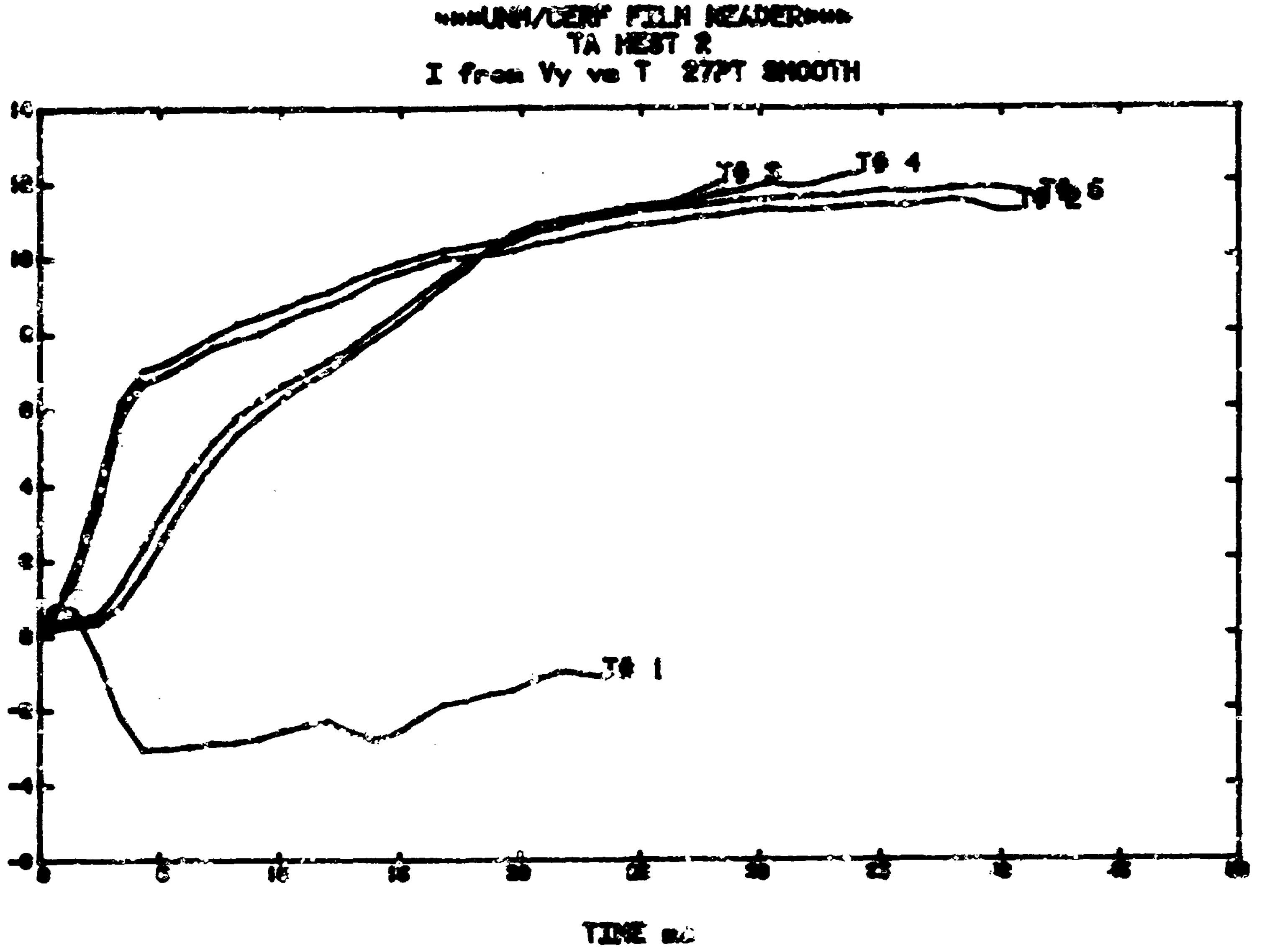

UNM/CERF FILM READER
TA HEST 1, 1000 fr/sec
I from Vy vs T 13PT SMOOTH
IMPULSE psi-sec
14
12
10
8
6
4
2
0
-2
-4
-6
0
5
10
15
20
25
TIME ms
TG 2
TG 1

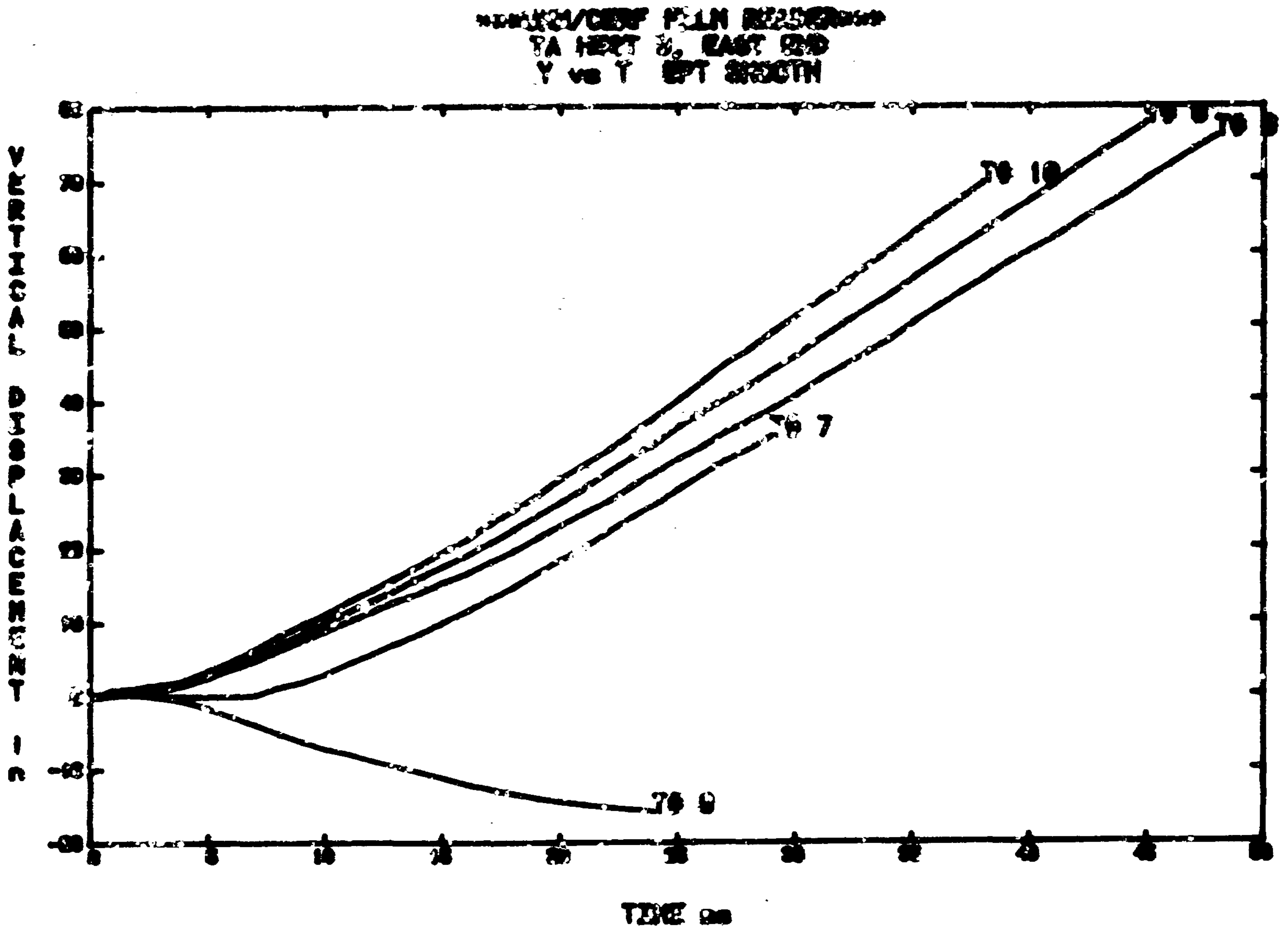
***UNM/CERF FILM READER***
TA HEST 1, 1250 fr/sec
I from Vy vs T 13PT SMOOTH
TA 4
TA 3
IMPULSE psi-sec
14
12
10
8
6
4
2
0
-2
-4
-6
0
5
10
15
20
25
TIME ms


UNM/CERF FILM READER
TA NEST 2
Y vs T 5PT SMOOTH
VERTICAL DISPLACEMENT - in
TIME ms
100
80
60
40
20
0
-20
0
5
10
15
20
25
30
35
40
45
50
TG 5
TG 2
TG 4
TG 3
TG 1

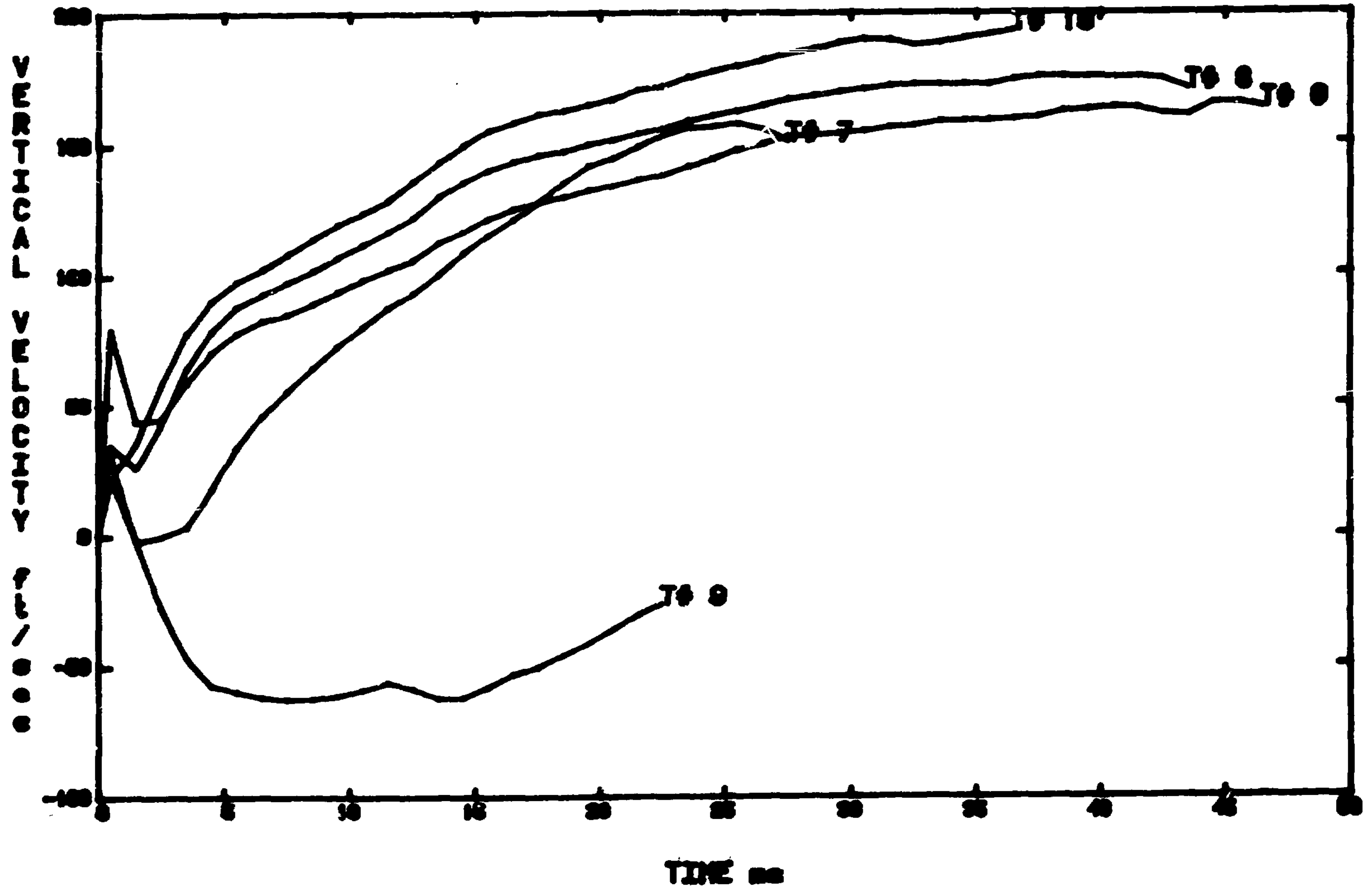
****UNM/CERF FILM READER****
TA HEST 2
Vy vs T 27PT SMOOTH

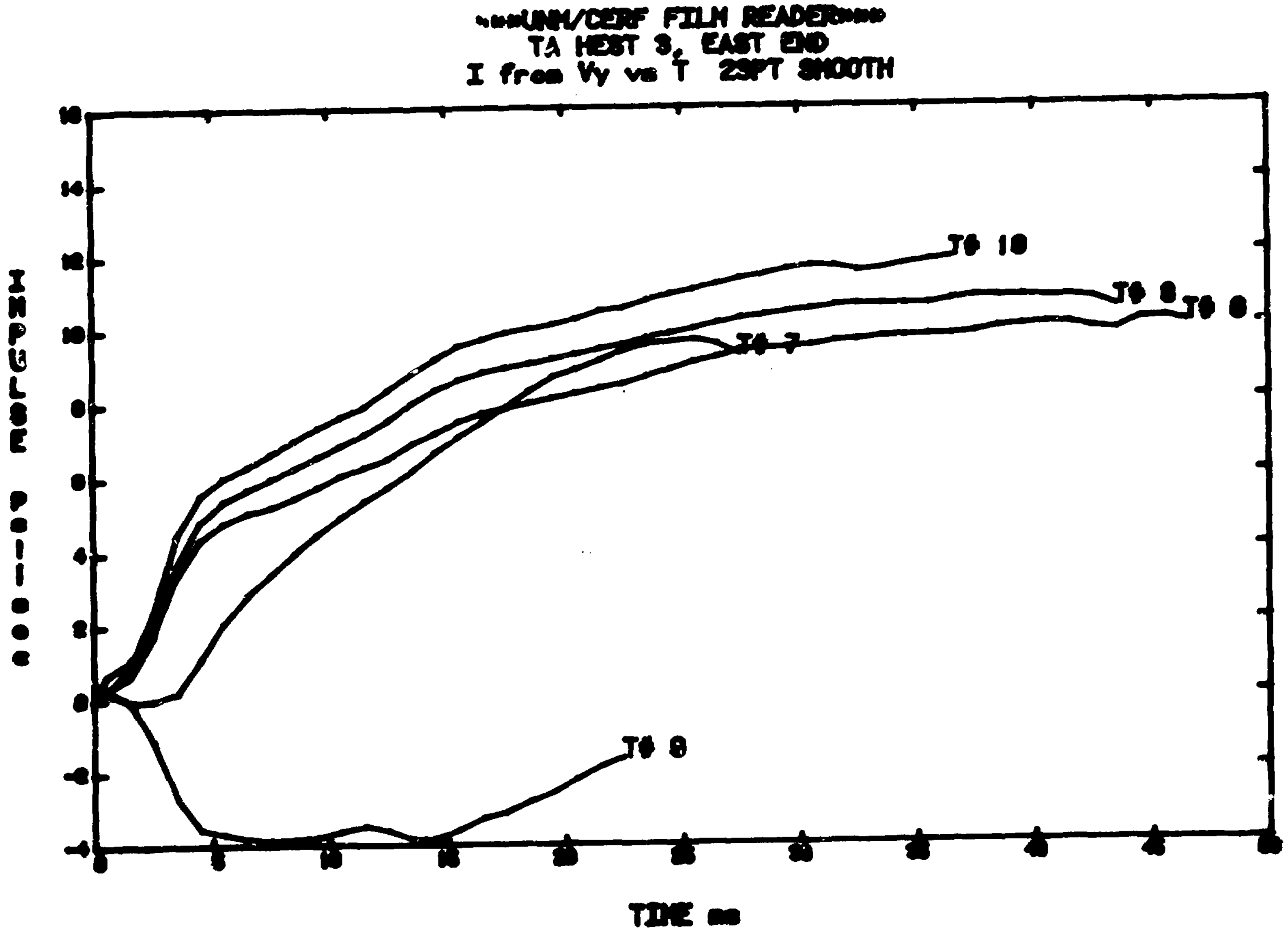



UNH/CERF FILM READER
TA WEST 2
I from Vy vs T 27PT SMOOTH
IMPULSE
TIME
T# 1
T# 3
T# 4
T# 2
T# 5
14
12
10
8
6
4
2
0
-2
-4
-6
0
5
10
15
20
25
30
35
40
45
50

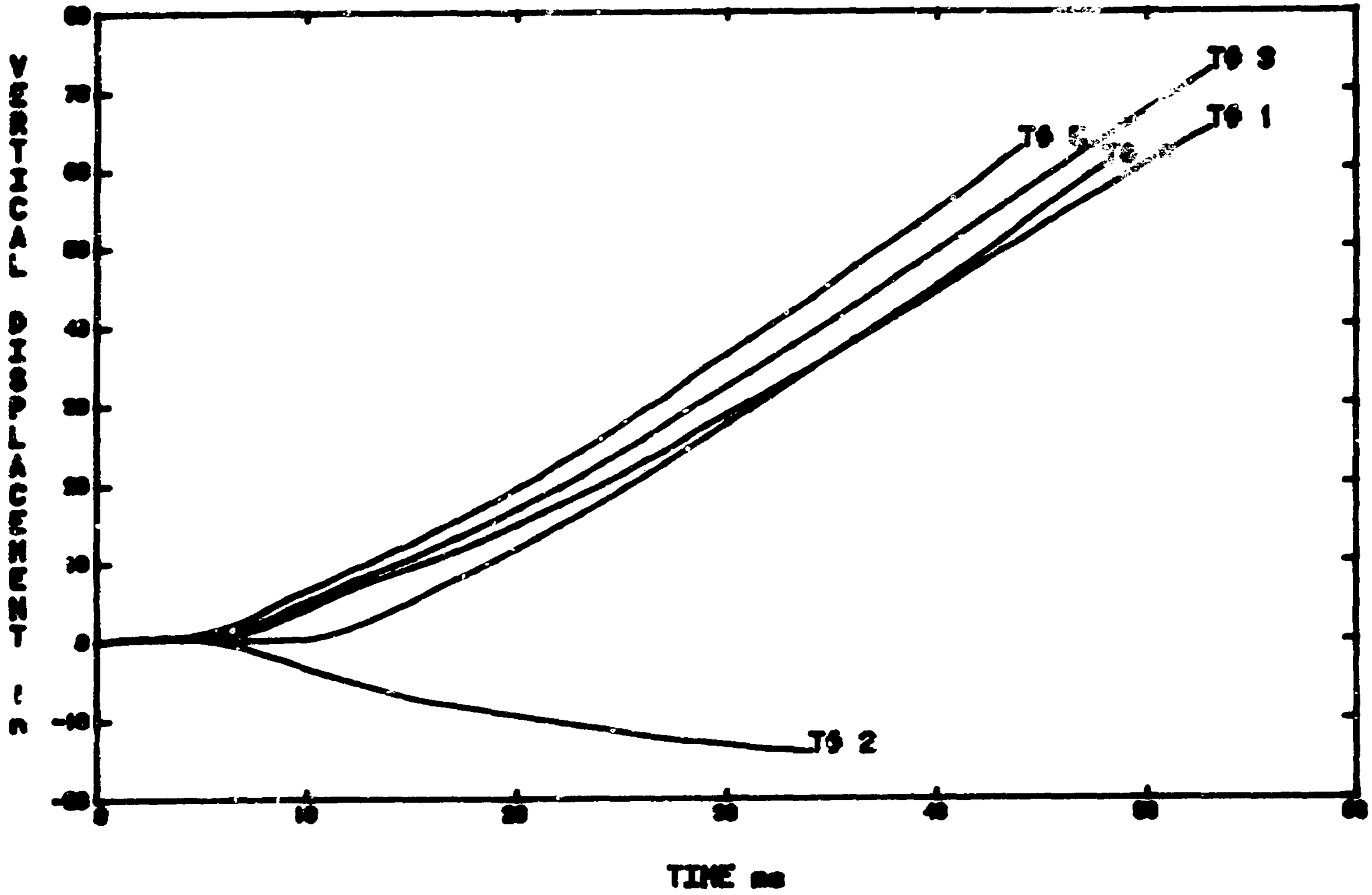

JCV/CERF FILM READER
TA HEPT 8, EAST END
Y vs T EPT SMOOTH
VERTICAL DISPLACEMENT in
TIME ms
80
70
60
50
40
30
20
10
0
-10
-20
0
5
10
15
20
25
30
35
40
45
50
TG 10
TG 8
TG 6
TG 7
TG 9

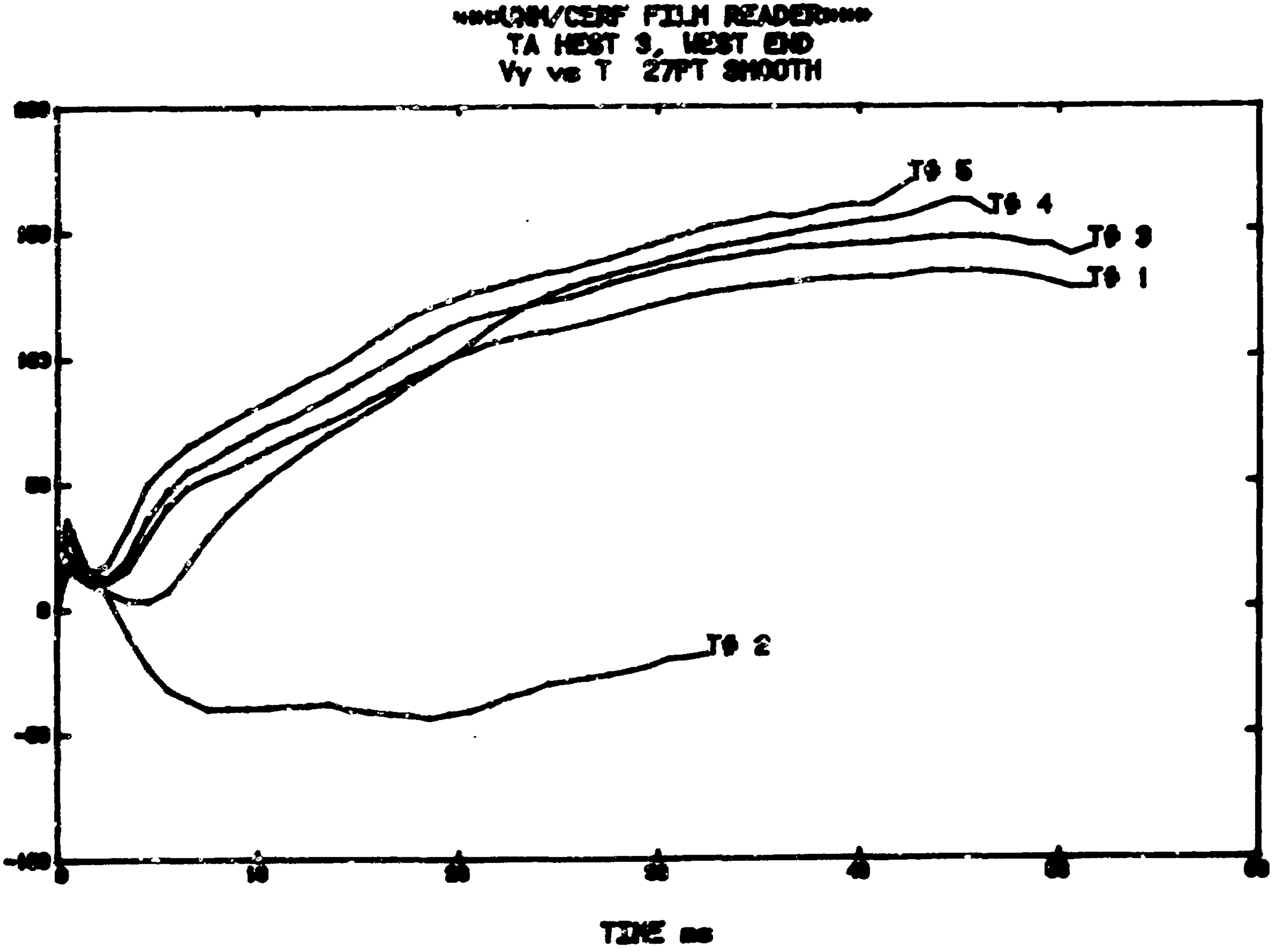
UNM/CERF FILM READER
TA WEST 9, EAST END
Vy vs T 23PT SMOOTH

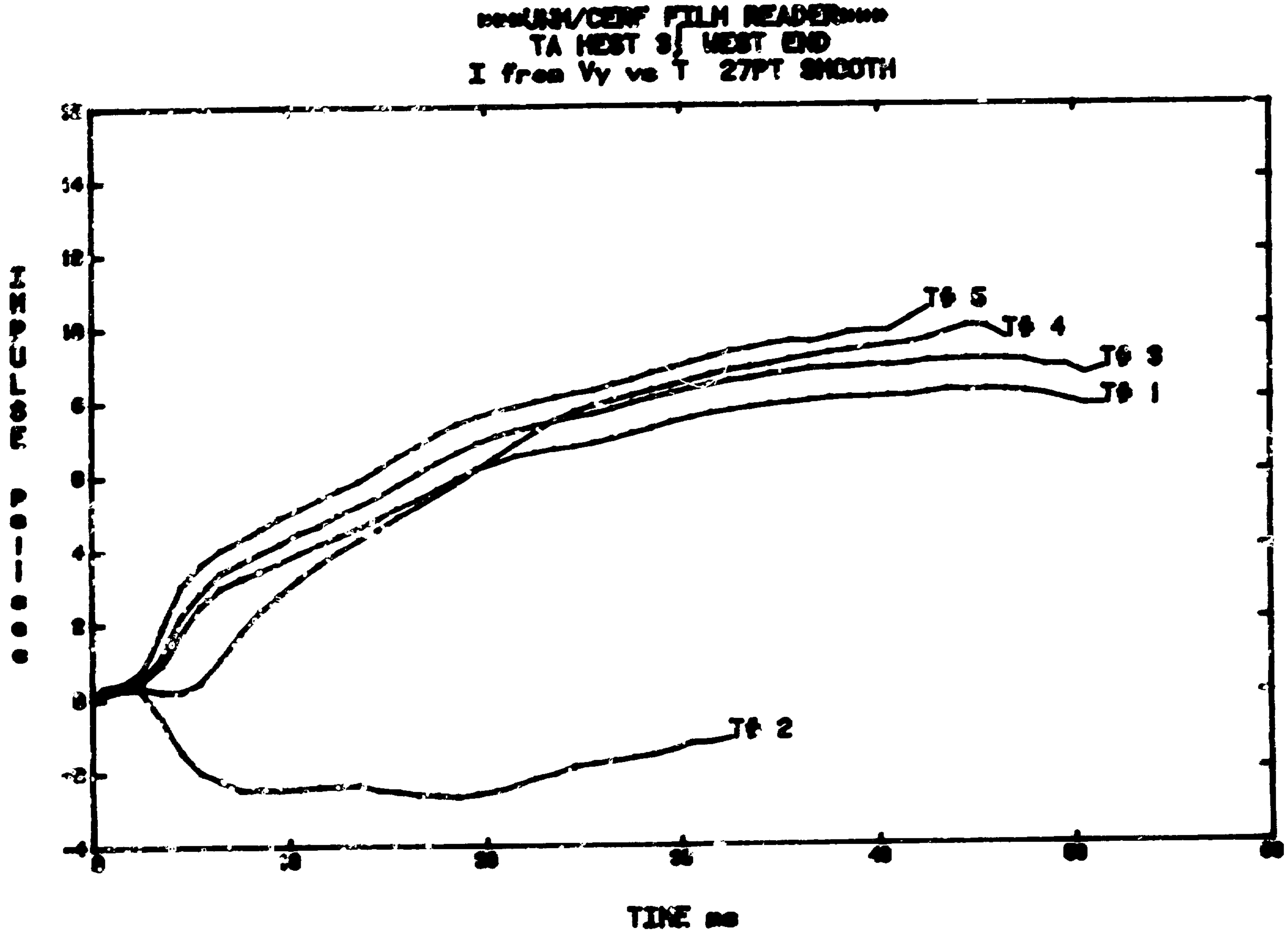


 ***UNM/CERF FILM READER***
TA WEST 3, EAST END
I from Vy vs T 25PT SMOOTH
IMPULSE psi-sec
TIME ms
16
14
12
10
8
6
4
2
0
-2
-4
0
5
10
15
20
25
30
35
40
45
50
T# 10
T# 9
T# 8
T# 7
T# 6

****UNM/CERF FILM READER****
TA WEST 3, WEST END
Y vs T 5PT SMOOTH




UNM/CERF FILM READER
TA WEST 3, WEST END
Vy vs T 27PT SMOOTH
VERTICAL VELOCITY ft/sec
200
150
100
50
0
-50
-100
0
10
20
30
40
50
60
TIME ms
T$ 5
T$ 4
T$ 3
T$ 1
T$ 2


UNM/CERF FILM READER
TA WEST 3, WEST END
I from Vy vs T 27PT SMOOTH
IMPULSE psi-sec
TIME ms
16
14
12
10
8
6
4
2
0
-2
-4
0
10
20
30
40
50
60
T$ 5
T$ 4
T$ 3
T$ 1
T$ 2

APPENDIX D

TEST INSTRUMENTATION DETAILS

		Page
TA HEST 1:	BLAST PRESSURE MEASUREMENTS	522
	TIME-OF-ARRIVAL MEASUREMENTS	523
TA HEST 2:	BLAST PRESSURE MEASUREMENTS	524
	TIME-OF-ARRIVAL MEASUREMENTS	525
TA HEST 3:	BLAST PRESSURE MEASUREMENTS	526
	TIME-OF-ARRIVAL MEASUREMENTS	527

Test: TA HEST 1 - Blast Pressure Measurements
Date: February 24, 1978

Measurement Number	Gage Number	Gage Type	Debris Shield	Locations						Posttest Elevation Change (ΔZ), in
				As Planned, in			As Built, in			
				X	Y	Z	X	Y	Z	
1	2-7	Kulite 30K	10	+2	+12	0	+2	+12-1/4	0	-12.06
2	4-1	Kulite 20K	18	-36	+60	0	-36	+60-1/4	0	-11.04
3	4-6	Kulite 20K	18	-36	-36	0	-35-3/4	-36-3/8	+3/16	-11.04
4	5-22	Kulite 20K	18	-36	-36	0	+36-1/2	-36-3/8	+1/8	-11.46
5	351	Bar 6K	None	+2	-6	0	+2-1/8	-6-1/8	+1/16	-11.88
6	353	Bar 6K	None	+1-3/8	-18	0	+15/16	-18	+1/16	-11.64
7	357	Bar 6K	None	+3/4	-30	0	+3/4	-30-1/4	+3/16	-11.04
8	362	Bar 6k	None	0	-42	0	-1/4	-42-1/2	+3/16	-10.62
										Average = -11.35

TA HEST 1 - Time-of-Arrival (TOA) Measurements

Measurement Number	Gage Type[a]	Locations, in			TOA[b], ms
		X	Y	Z	
1		+72	+24	+3-3/4	
2		+36	0	+3-3/4	
3		0	+24	+3-3/4	
4		-36	0	+3-3/4	
5		-72	+24	+3-3/4	
6		+72	-72	+3-3/4	
7		+36	-48	+3-3/4	
8		0	-72	+3-3/4	
9		-36	-48	+3-3/4	
10		-72	-72	+3-3/4	
11		0	+12	+3-3/4	
12		0	0	+3-3/4	
13		0	-12	+3-3/4	
14		+72	+72	+5-3/8	
15		+36	+48	+5-3/8	
16		0	+72	+5-3/8	
17		-36	+48	+5-3/8	
18		-72	+72	+5-3/8	
19		+72	-24	+5-3/8	
20		+36	-48	+5-3/8	
21		0	-24	+5-3/8	
22		-36	-48	+5-3/8	
23		-72	-24	+5-3/8	

[a] All gages were crystal type.

[b] Data unavailable due to pin box failure.

Test: TA HEST 2 - Blast Pressure Measurements
Date: March 24, 1978

Measurement Number	Gage Number	Gage Type	Debris Shield	Locations						Posttest Elevation Change (ΔZ), in
				As Planned, in			As Built, in			
				X	Y	Z	X	Y	Z	
1	4-1	Kulite 20K	18	+57	0	0	+57	0	+1/8	-8.52
2	4-5	Kulite 20K	12	+36	+12	0	+35-1/2	+12	+3/16	-8.16
3	5-22	Kulite 20K	18	+21	-48	0	+21	-48	+3/16	-6.54
4	2-7	Kulite 30K	10	0	0	0	0	0	0	-7.38
5	5-23	Kulite 20K	18	-21	+48	0	-21-3/8	+48	0	-6.90
6	5-37	Kulite 20K	18	-36	-12	0	-36	-11-3/4	+1/16	-6.72
7	355	Bar 6K	None	+12	0	0	+12-5/16	0	+1/16	-7.38
										Average = -7.37

TA HEST 2 - Time-of-Arrival (TOA) Measurements

Measurement Number	Gage Type[a]	Location, in			TOA, ms
		X	Y	Z	
1		+72	+24	+3-3/4	0.523
2		+36	0	+3-3/4	0.687
3		0	+24	+3-3/4	0.842
4		-36	0	+3-3/4	1.006
5		-72	+24	+3-3/4	1.162
6		+72	-72	+3-3/4	0.522
7		+36	-48	+3-3/4	0.683
8		0	-72	+3-3/4	0.849
9		-36	-48	+3-3/4	1.010
10		-72	-72	+3-3/4	1.165
11		0	+12	+3-3/4	0.934
12		0	0	+3-3/4	1.153
13		0	-12	+3-3/4	Failed
14		+72	+72	+5-3/8	0.532
15		+36	+48	+5-3/8	0.692
16		0	+72	+5-3/8	0.946
17		-36	+48	+5-3/8	1.020
18		-72	+72	+5-3/8	Failed
19		+72	-24	+5-3/8	0.531
20		+36	-48	+5-3/8	0.683
21		0	-24	+5-3/8	0.857
22		-36	-48	+5-3/8	1.019
23		-72	-24	+5-3/8	1.160

[a] All gages were crystal type.

Test: TA HEST 3 - Blast Pressure Measurements
Date: April 27, 1978

Measurement Number	Gage Number	Gage Type[a]	Debris Shield	Locations						Posttest Elevation Change (ΔZ), in
				As Planned, ft			As Built, ft			
				X	Y	Z	X	Y	Z	
1	2-2	30K	10	+7.0	+1	0	6.968	+1	0.00	-18.12
2	2-4	30K	10	+7.0	-1	0	6.974	-1	+0.03	-17.40
3	2-5	30K	10	+14.0	+1	0	14.000	+1	0.00	-15.36
4	2-9	30K	10	+14.0	-1	0	14.000	-1	+0.02	-15.24
5	2-11	30K	10	+21.0	+1	0	21.000	+1	+0.02	-13.92
6	2-12	30K	10	+21.0	-1	0	20.989	-1	+0.02	-12.72
7	4-3	20K	18	+28.0	+1	0	28.000	+1	-0.04	-12.48
8	4-4	20K	18	+28.0	-1	0	28.000	-1	-0.01	-11.88
9	4-6	20K	18	+35.0	+1	0	34.989	+1	-0.07	-12.00
10	4-7	20K	18	+35.0	-1	0	34.979	-1	-0.05	-10.92
11	4-9	20K	18	+42.0	+1	0	42.000	+1	-0.09	-12.84
12	4-11	20K	18	+42.0	-1	0	42.000	-1	-0.03	-11.52
13	4-14	20K	18	+49.0	+1	0	49.000	+1	-0.07	-13.20
14	4-27	20K	18	+49.0	-1	0	48.968	-1	-0.09	-12.36
15	5-21	20K	18	+56.0	+1	0	56.020	+1	-0.10	-12.24
16	5-22	20K	18	+56.0	-1	0	56.000	-1	-0.11	-12.00
17	5-23	20K	18	+63.0	+1	0	63.000	+1	-0.09	-11.64
18	5-26	20K	18	+63.0	-1	0	63.000	-1	-0.07	-11.52
19	2-13	30K	10	+24.5	-1	0	24.500	-1	-0.01	-12.24
20	2-37	20K	18	+45.5	-1	0	45.468	-1	-0.04	-11.88
										Average = -13.07

[a] All gages were Kulite type.

TA WEST 3 - Time-of-Arrival (TOA) Measurements

Measurement Number	Gage Type[a]	Locations, ft			TOA, ms
		X	Y	Z	
1		0.0	+4.0	0.312	0.400
2		0.0	0.0	0.312	0.440
3		0.0	-4.0	0.312	0.405
4		9.0	0.0	0.312	0.825
5		18.0	+4.0	0.312	1.309
6		18.0	-4.0	0.312	1.266
7		27.9	+4.0	0.312	Failed
8		27.9	0.0	0.312	1.682
9		27.9	-4.0	0.312	1.712
10		35.9	+2.0	0.312	2.070
11		40.4	+4.0	0.312	2.309
12		40.4	0.0	0.312	2.291
13		40.4	-4.0	0.312	2.297
14		44.4	+2.0	0.312	2.488
15		47.9	0.0	0.312	2.661
16		50.9	+2.0	0.312	2.821
17		53.8	+4.0	0.312	2.975
18		53.8	0.0	0.312	2.973
19		53.8	-4.0	0.312	2.988
20		56.5	+2.0	0.312	3.124
21		59.2	0.0	0.312	3.273
22		61.7	+2.0	0.312	3.416
23		64.0	+4.0	0.312	3.552
24		64.0	0.0	0.312	3.569
25		64.0	-4.0	0.312	3.551
26		66.3	+2.0	0.312	3.683
27		68.5	0.0	0.312	3.819
28		0.0	+4.0	0.447	Failed
29		0.0	0.0	0.447	0.442
30		0.0	-4.0	0.447	0.489
31		9.0	+4.0	0.447	0.896
32		9.0	-4.0	0.447	0.885
33		18.0	0.0	0.447	1.258
34		27.9	+4.0	0.447	1.715
35		27.9	0.0	0.447	1.701
36		27.9	-4.0	0.447	1.731
37		40.4	0.0	0.447	2.290
38		47.9	+4.0	0.447	2.674
39		47.9	0.0	0.447	2.646
40		47.9	-4.0	0.447	2.687
41		53.8	0.0	0.447	2.981
42		59.2	+4.0	0.447	3.285
43		59.2	0.0	0.447	3.280
44		59.2	-4.0	0.447	3.296
45		64.0	0.0	0.447	3.559
46		68.5	+4.0	0.447	3.826
47		68.5	0.0	0.447	3.825
48		68.5	-4.0	0.447	3.825

[a] All gages were crystal type.

APPENDIX E

HEST LOCKUP CODE DESCRIPTION

The lockup impulse code is used to calculate HEST pressure and impulse histories for a given initial pressure, cavity, and overburden dimensions soil properties, as well as the ratio of specific heats (γ) of the detonation products. The code is small enough to run on the HP 9820A programmable calculator, and a BASIC version for the Tektronix 4051 is available. No provision is made for handling layered soils; the overburden and test bed materials are assumed uniform and homogeneous. The calculations are one-dimensional, and the three-dimensional properties of a HEST calculation are approximated. The detonation product/air mix in the cavity is assumed to have a uniform pressure distribution, and dynamic properties are neglected. The detonation product/air mix is assumed to be a "gamma law" gas with gamma held constant. The lockup code is typically used to design a HEST so that its pressure history matches a given nuclear waveform. This is done by varying cavity and overburden dimensions until the calculated HEST waveform most closely matches the desired nuclear waveform.

The code is also used in the analysis of data obtained from a HEST test. In this case, one inputs the appropriate soil model, as-built dimensions, etc., into the code and varies the initial pressure until the calculated HEST impulse-time trace most closely matches the given data trace. This initial pressure is called the Simulation Peak Pressure. This method of determining peak pressures is an alternative to using the peak pressure routine[a]. In fitting a data trace with the lockup code the user determines the quality of the fit by inspection. Since these HESTs were designed with the lockup code, fitting data traces with the code yields information about the quality of the simulation. The lockup code should be used in the analysis of HEST test data whenever the results of that analysis are to be used as inputs in future HEST designs.

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[a] Hampler, Howard W., and Earickson, Jeff A., *High-Pressure and Foam HEST Analyses*, CERF AST-10, Civil Engineering Research Facility, University of New Mexico, Albuquerque, New Mexico, publication pending.